NEERING
BRARY

NOV 28 1944



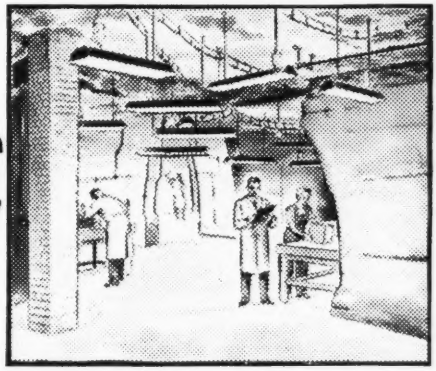
# ELECTRICAL REVIEW

FOUNDED 1872

CXXXV. No. 3493 NOVEMBER 3, 1944 9d. WEEKLY

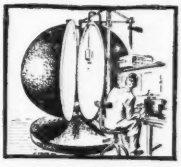


RESEARCH BEHIND LIGHTING

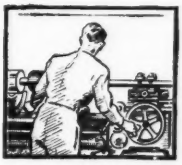


## DAYLIGHT *–Underground!*

HERE is a modern factory *hundreds of feet below ground* where Mazda fluorescent lighting provides working conditions approximating to broad daylight! This remarkable achievement in lighting technique is due in large measure to the data provided by a range of delicate scientific instruments used in the BTH Research Laboratories. The Integrating Photometer — here illustrated — is just one of these valuable "assistants" constantly working for the BTH Lighting Engineers.



Integrating Photometer



Ideal Lighting

MAZDA LAMPS

LIGHTING ADVISORY SERVICE

The British Thomson-Houston Co. Ltd., Crown House, Aldwych, London, W.C.2

M4037

# ENERGY *FOR THE* NATION'S FACTORIES, WORKS & PUBLIC SERVICES

The last war taught this country the tremendous industrial and military importance of nation wide supply of electricity. In the quarter century that has elapsed electric transmission by C.M.A. Cables has increased by leaps and bounds and is daily sustaining the nation's enormous production of munitions of war.

**C.M.A. CABLES**

CERTIFICATION MARK Regd Trade Mark Nos. 660, 883 - 6 - 7

**MEMBERS OF THE C.M.A.**

The Anchor Cable Co. Ltd.
British Insulated Cables Ltd.
Callender's Cable & Construction Co. Ltd
Connollys (Blackley) Ltd
The Craigpark Electric Cable Co. Ltd.
Cromoton Parkinson Ltd. (Derby Cables Ltd.)
The Enfield Cable Works Ltd
Edison Swan Cables Ltd
W T Glover & Co Ltd
Greengate & Irwell Rubber Co. Ltd
W T Henley's Telegraph Works Co. Ltd.
Johnson & Phillips Ltd.
The India Rubber, Gutta-Percha & Telegraph Works Co. Ltd. (The Silvertown Co.)
Liverpool Electric Cable Co. Ltd.
The London Electric Wire Co. and Smiths Ltd.
The Macintosh Cable Co. Ltd
The Metropolitan Electric Cable & Construction Co. Ltd
Pirelli-General Cable Works Ltd. (General Electric Co. Ltd.)
St. Helens Cable & Rubber Co. Ltd
Siemens Brothers & Co. Ltd. (Siemens Electric Lamps and Supplies Ltd.)
Standard Telephone & Cables Ltd
Union Cable Co. Ltd

*Advert. of the Cable Makers' Association, High Holborn House, 52-54 High Holborn, London, W.C.1.*
*Phone: Holborn 7633*

944

# N'S CES

hendous
on wide
ry that
Cables
ily sus-
f muni-

.A.

bber,
Tele-
Ltd.
Co.)
ric
Ltd
ectric
miths
Ltd.
Ltd
tan
&
o.
Ltd
td.
ric
Ltd.)
le &
Ltd
ers &
mens
and
Ltd.)
hone
Ltd
Ltd

W.C.I.

# ELECTRICAL REVIEW

November 3, 1944

Managing Editor : Hugh S. Pocock, M.I.E.E.

Technical Editor : C. O. Brettelle, M.I.E.E.

Commercial Editor : J. H. Cosens


## Contents :—


| | Page |
|---|---|
| Editorial.—The Broad Engineering View | 613 |
| Factory Primary Distribution | 616 |
| Fuel Efficiency | 619 |
| Street Lamp Renewals. By J. C. Beard, B.Sc., A.M.I.E.E. | 620 |
| Multiple Air Compressors. By G. McAuley | 621 |
| Industrial Organisation | 622 |
| Welding Load | 623 |
| Forthcoming Events | 624 |
| Shannon Scheme | 625 |
| Radio Aerials | 625 |
| Flue-dust Precipitation | 626 |

*Contents continued :—*

| | Page |
|---|---|
| Personal and Social | 627 |
| Correspondence | 629 |
| Commerce and Industry | 632 |
| Economics of Water Power | 635 |
| Electricity Supply | 637 |
| Organising Installation Work. By T. Dunwoody, Associate I.E.E. | 639 |
| Latin-American Trade | 641 |
| Financial Section | 642 |
| New Patents | 647 |
| Contract Information | 648 |
| *Classified Advertisements* | 67 |
| *Index to Advertisers* | 76 |



**EDITORIAL, ADVERTISING & PUBLISHING OFFICES : Dorset House, Stamford St., London, S.E.1**

Telegraphic Address : "Ageekay, Sedist, London." Code: ABC. Telephone No.: Waterloo 3333 (35 lines).

Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage. Entered as Second Class Matter at the New York, U.S.A., Post Office.

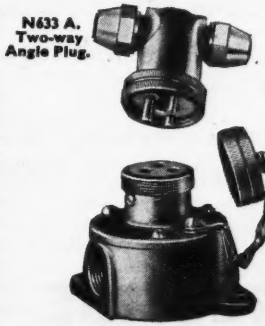
Annual Subscription, Post free : British Isles, £2 7s. 8d. ; Canada, £2 3s. 4d. ; Elsewhere, £2 5s. 6d.

Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW LTD., and crossed "Lloyds Bank."



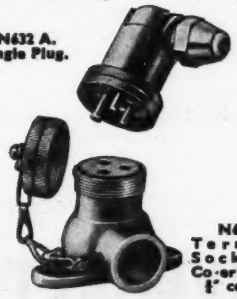
**PLUGS AND SOCKETS**

**5-amp, 250-volt, 3-pole couplings**



N633 A. Two-way Angle Plug.

N631 A.—Cast Iron Through Socket screwed ¾" conduit.



N632 A. Angle Plug.

N663 A. Terminal Socket and Cover screwed ¾" conduit.

**SIMMONDS & STOKES LTD.**

Victoria House, Southampton Row, London, W.C.1. Holborn 8637 & 2163

# RELAYS

## For Operating or Protective Purposes from Micro-Amperes to Megawatts

## Current–Voltage–Power–Reactive kVA Frequency–Speed

- CONTACTS :—Maximum and/or Minimum Direct Acting or Electronic Relay Contacts.
- OPERATION :—Instantaneous—Definite Time Lag—Continuous "Inching."
- Scientifically designed Magnetic damping—Bold reading scale—High working forces.

*Write for particulars.*

**EVERETT EDGCUMBE**

Manufacturers of all kinds of indicating and recording electrical instruments. Photometry experts

COLINDALE WORKS, LONDON, N.W.9

Phone : COLINDALE 6045

# ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXV. No. 3493. NOVEMBER 3, 1944 9d. WEEKLY


# The Broad Engineering View

## Folly of Hand-to-Mouth Policy

AMID the contentions engendered by sundry plans for the betterment of electricity supply there is some risk lest the real purpose be obscured. Defects are to be expected in an industry whose growth has been rapid enough to outstrip even the huge strides made in technology. One not unnatural result has been a corresponding time-lag in adapting viewpoints to modern conditions. Thus when the lighting load absorbed most of the electrical output each application for motive power, dumped off-peak at low rates, might become a case for special consideration, both engineering and financial, because of voltage regulation troubles on small mains and capital charges on possibly unremunerative extensions. Later, cookers provided special cases (entailing doubts as to whether the load was one to be encouraged) and so on.

### Early Lack of Vision

Those responsible for electricity supply in the early days did not always show an optimism about the future which, as is now apparent, would have been fully justified. Hence came a tendency towards piecemeal methods of coping with growing demands instead of towards the design of distribution systems that would, with the aid of superimposed high-voltage mains (a later development), be adequate to meet the demands of ten to twenty years ahead. A hand-to-mouth policy of this kind was more often dictated by short-sighted financial expediency than by the "broad engineering view," as Mr. H. W. Grimmitt termed it in his chairman's address to the I.E.E. Transmission Section, reported in our last issue.

In this address a close enough guide for future estimates was given as a continuance of the national rate of growth of output over the last ten years. Any move that would materially vary it, it was considered, was to be deprecated. While a likelihood of the annual percentage increase being substantially exceeded seems remote, it certainly cannot be assumed that a rate of growth up to the standard can be maintained automatically.

### Work for Consumers' Engineers

Great efforts will be needed from consumers' engineers of all undertakings, backed by the Electrical Development Association, to ensure that—leaving out of account competition by private plants—electricity is adopted for whatever purpose it is economically suited, in the widest sense. Moreover, it will be extremely difficult to forecast the trend of industrial power consumption. If a proportionate advance is to be made, some compensation for the cessation of the armaments load will have to be found in manufacture for export as well as for home markets—a matter outside the control of the electrical industry.

To the maintenance of growth of output even such practical engineering problems as voltage and tariff standardisation are subsidiary. Present anomalies are irritants that hinder fulfilment of the larger purpose and are especially to be avoided in dealing with newer consumers, representing one-fifth of the population, who live in rural areas. A great need is increased revenue per farm. That is not to be secured (rather the contrary) through requiring guarantees

of unduly high minimum consumption or through imposing penalising tariffs on certain uses. Particular mention was made in the address of welding, pumping and grain-drying. These are, or can become, ordinary (not freak) services. They may individually take few kWh in the year, too few, therefore, to affect adversely the finances of modern undertakings. Any small losses incurred in catering for them fully should be outweighed by the value of the demonstration they afford of public electricity supply as an incomparable and unrestricted service that is well worth its relatively low over-all cost to consumers.

**E.D.A. Management**

SINCE Mr. A. C. Cramb retired last year the position of director of the British Electrical Development Association has been vacant, although the work has been carried on by Mr. V. W. Dale, with the title of assistant director and secretary. There has been much discussion of the question whether the directorship should be filled during the war or left until later when, some have contended, many possible candidates would be free to take the post. Now the Council has decided to make an appointment " to enable the industry to play its full part in public affairs during the difficult period that will follow the termination of hostilities." The new official will bear the somewhat grandiose title of director-general. In the meantime Mr. Dale has been appointed general manager and secretary of the Association and is thus released from the anomalous position of " assistant " to a non-existent director.

**Freedom of Choice**

No. 10 of the Ministry of Works Post-War Building Studies is a report by a committee appointed by the Coal Utilisation Research Association. Its main purpose is to recommend desirable improvements in solid-fuel appliances but in doing so it naturally has something to say regarding competitive methods. It is considered highly desirable that the householder should be free to chose between solid fuel, gas and electricity, subject to the proviso that this freedom should be compatible with general housing and fuel policy. The need for low-cost housing, smoke abatement and peak load requirement are three considerations which may restrict freedom of choice. The committee naturally considers that solid fuel will be the basis of most domestic heating and refers to the difficulties likely to be encountered by the gas and electricity supply industries in meeting peak loads if the quantities of sold fuel were substantially reduced.

**Appropriate Fuels**

THE report goes on to say that the economic use of our national coal resources requires that the most appropriate fuels should be used for each particular purpose and that development of a national fuel policy may therefore necessitate some limitation of the principle of freedom of choice. That appears to mean that, if it is thought desirable, provision should be made in a house for solid fuel, gas and electricity. If this is done it would seem to militate against the requirement of low building costs—as Mr. F. W. Purse has pointed out in this journal.

**Theory and Practice**

IN the numerous references to engineering training made recently in technical bodies, there is implicit recognition of its main purpose. Important as the provision of an adequate educational framework undoubtedly is, it falls far short of its purpose unless it stimulates students to apply intelligently all the knowledge they are capable of assimilating. In his presidential address to the North-East Coast Institution of Engineers and Shipbuilders, Sir Summers Hunter shows that the old saying about an ounce of practice (which is based on experience of the past) being worth a ton of theory has lost any validity it may once have possessed. In the light of the rapidity of technical developments, the aid of the scientist is being invoked more and more in solving day-to-day problems of the workshop and still more in laying down the lines of future advance.

**Technical Training**

GENERAL support of these views appears in the inaugural addresses given to many of the component groups of the Institution of Electrical Engineers this autumn. Among points made by Mr. J. Cormack is the very pertinent one that especial ability to impart instruction should be the first qualification of a technical teacher, rather than academic distinction or achievements in research. A natural flair would be considerably enhanced if the lecturer were permitted to

return to industry periodically, as Sir Summers Hunter intimates. Mr. F. W. Lawton warns against the adverse effects of a narrow vocational training and Mr. W. Kidd stresses the value of intercourse at college in developing character. Although Mr. G. O. Watson's remarks were primarily concerned with marine electrical engineers, their implications are much wider.

**Lincoln Compromise**

THE Electricity Commissioners have issued their decision in the Lincoln case. The Corporation is to be allowed to extend its St. Swithin's station but must substitute 90-ft. wooden natural draught cooling towers for the 230-ft. concrete ones which it proposed to erect. The two chimneys of the extension are to be reduced from 279 ft. to 225 ft. high and the station buildings are not to exceed 90 ft. in height. It is considered that the site is a good one for the purpose and more economical than the first stage of a hypothetical Central Board station on the Trent.

**Exploration Before Experiment**

INCORRECT inferences are sometimes drawn from achievements by inventors in flat contravention of accepted doctrine. Success in such cases has been due not to the absence of a "handicap to too much knowledge," but rather to a misunderstanding by earlier workers in the same field of scientific laws and relationships. More extensive knowledge on the part of the latter would have shown that their lines of investigation could not have achieved the desired results. This matter was put in its proper perspective in the chairman's address to the I.E.E. Measurements Section last week. Dr. W. G. Radley's experience is that a careful theoretical study of a subject in all its aspects should be made before experimental work is started.

**Research Interchange**

IN supporting the view that scientists employed in industry should return periodically to the universities in order to study fundamental problems and that university research workers should, conversely, be brought into close touch with practical problems of industry, Dr. Radley would include among the latter those concerned with even the most abstract types of research. In addition to the more obvious advantages of such an interchange, there is the training it provides in forming judgment as to how far side issues of fundamental research may be worth following up by others on the look out for subjects for applied research. Such side issues have often had more far-reaching effects than the original line of inquiry.

**Farthing a Unit**

ELECTRICITY consumers at Mountain Ash who have come to look forward to the yearly "Christmas box" in the shape of a rebate on the already remarkably low charges have been promised a "victory bonus" when peace comes. As it is, the gift this year is more generous than before, the flat-rate charge of 2½d. per kWh being reduced to ½d. for the first 100 kWh and 1d. thereafter, with no meter rents. Two-part tariff consumers are to receive an extra ½d. discount on the first 100 kWh. Only the need to avoid removing the incentive to economise consumption prevented the Council from giving consumers their electricity free this Christmas. In making the announcement at the Council's October meeting, Councillor Tom Morgan said that the financial position of the undertaking was stronger than ever, and he paid a well-merited tribute to the general manager, Mr. E. W. Jones, and his staff.

**Textiles**

THE fundamental cause of the unfavourable comparison between the equipment of British and United States mills which has been drawn by the Cotton Textile Mission is that over there, to quote the Report, "the policy—not perhaps yet fully extended—is to let the machine do more work and the workmen do less. It is proving the correct policy." Although to modernise the weaving section of the industry would entail a major industrial operation that is not immediately practicable, the spinning section lends itself more readily to measures for increasing production per man-hour. Better lighting in weaving sheds also offers electrical opportunities, as it is criticised as being often of insufficient intensity, whereas in the United States illumination almost entirely by fluorescent lamps is said to be good over every part of the machines. The recent exhibition in Manchester described in this issue shows what is possible here.

# Factory Primary Distribution

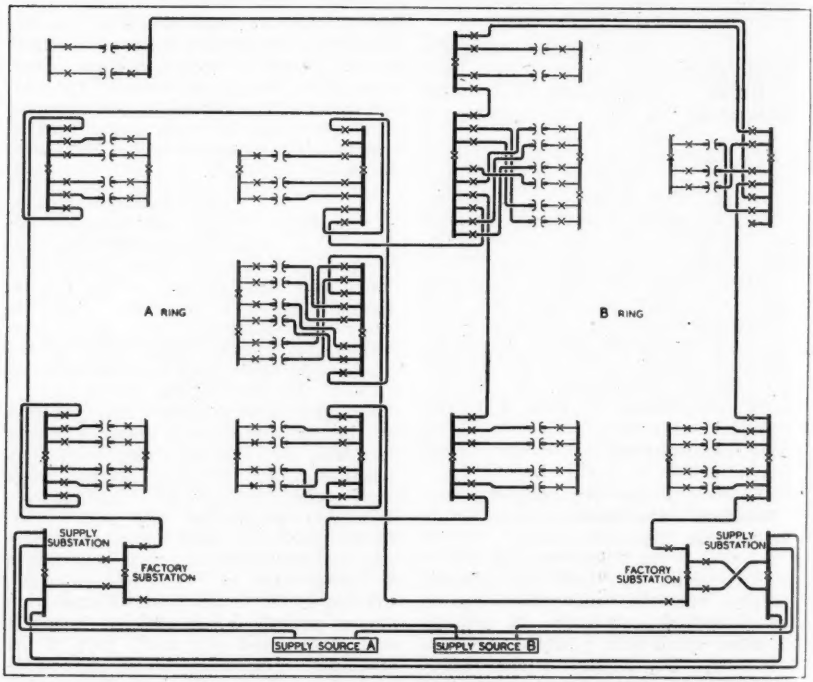
## The High-Voltage System and Substations at a Large Aero-Engine Works

THE scheme described in this article relates to the primary distribution at 11 kV at a very large and modern Rolls-Royce aero-engine works. The factory site is rectangular and accommodates many large buildings all of about the same size and divided and bordered by roadways running at right angles. Electricity is initially received at two public supply substations at the two corners on one side of the factory site. Into each of these public supply substations is brought a feeder from each of two supply sources, group A and group B at the power station.

As there are reactors between the groups at the power station, they must not, except in emergency, be paralleled anywhere externally on the system. The switchboard in each public supply substation is therefore equipped with a busbar coupler which is normally open, thus segregating groups A and B. In addition to the outgoing feeders, the two public supply substations are linked by two direct interconnectors, one for each group.

Adjacent to each supply substation and part of the same building there is the main factory substation which comprises in each case a five-panel 11-kV switchboard as follows: Outgoing group A, incoming group A, busbar coupler, incoming group B, outgoing group B. The busbar coupler is normally open. The incoming feeders from the public supply substation consist of two 0·2 sq. in. p.i., l.c., s.w.a. cables in parallel in each case. This switchgear is of the Crompton Parkinson M.C.A.4 type, with vertical isolation and spring closing, and each circuit-breaker has carrying and rupturing capacities of 600 A and 250 MVA, respectively.

On each of the incoming circuit-breakers on the main factory substation switchboards there are a voltmeter, three ammeters (one on




**The factory h.v. scheme consists essentially of two main h.v. distributors, each embracing some transformer substations, connecting the corresponding groups in the main substations**

**The main factory substation switchgear is of the spring-closing vertical-isolation type**

each phase) and a power-factor meter. Groups A and B in each main factory substation each carry a combined m.d. and kWh meter, a check meter and a reactive kVA meter. A summation meter is also provided at each of these substations to summate the kWh readings, and a further summation meter is provided in one of the substations to summate the two substation summations, *i.e.*, the total factory supply. All three of the summation meters are provided with printometer charts.

The factory high-voltage distribution scheme proper consists essentially of two main 11-kV distributors connecting corresponding groups in the two main factory substations, so that by connecting from group A in one main factory substation to group A in the other main factory substation a high-voltage ring main is formed. The arrangements are similar with B group. From each ring main a number of transformer substations are supplied, six in one case and five in the other, located at suitable load centres throughout. When running normally each ring main is open at a point approximately midway, with respect to load, between the two main substations, so that, in effect, the factory is being supplied by four open-ended feeders. From one main factory substation three transformer substations are normally fed on A group, and similarly three other transformer substations are fed on B group. This scheme is repeated from the other main factory substation, except that there are three transformer substations on the feeder served by A group and two transformer substations on the feeder served by B group.

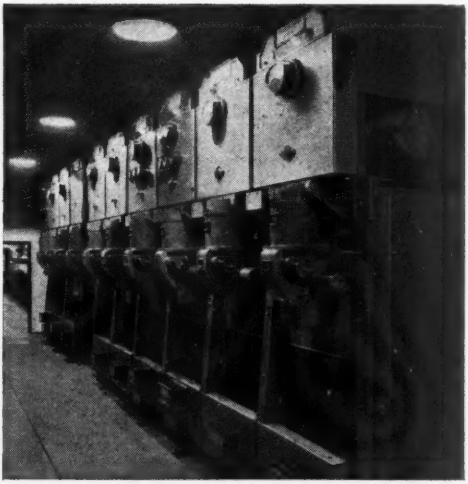
Between two of the transformer substations, one on A supply and one on B supply, is an interconnector which is normally left open because it is necessary to operate the feeders on the two supplies A and B separately, to ensure satisfactory operation of the protection equipment in view of the supply authority's system of reactive equipment across the main supply sources. Under emergency conditions, however, the interconnector could be closed; also the group A and B rings could be closed, respectively. The main value of the interconnecting scheme

**In addition to normal metering the two supplies for the substation are summated, and in one of the substations the two substation supplies are also summated by the top meters**

as a whole lies in the fact that blocks of load can be easily transferred from one feeder to another to suit the factory requirements, or from one supply to another to suit the external supply conditions.

For the h.v. distributors and the pilot cables of the protection system there is throughout the factory a system of earthenware ducting which is suitably drained and provided with man-holes at short intervals to facilitate cabling. The system embraces two six-inch ducts for the h.v. cables and one four-way four-inch duct for the pilots. The distributors are 0·25-sq. in. 3-core p.i., l.c., s.w.a., jute-served cables, and the pilots are 2-core p.i., l.c., s.w.a. cables.

The protection of the system between the main and transformer substations is by the "Translay" scheme with back-up overload and earth-leakage protection by Nalder Bros. & Thompson, Ltd., whereas the incoming supply to the main factory substation has straight overload protection. The current transformers throughout the feeders all have a 300 to 5 ratio.



**The factory substation circuit-breakers have carrying and rupturing capacities of 600 A and 250 MVA, respectively**

It will be appreciated, of course, that the main substations are switching stations only, and that they each comprise merely one essential room for the 11-kV switchboard. In the case of the transformer substations, however, there is a h.v. switchboard room comparable with that in each of the main factory substations, while the l.v. switchboard room may be considered as an extension to the h.v. room with insetted in it transformer cubicles in such a way that the doors of the h.v. and l.v. sections and of the transformer cubicles all open out on one side of the structure, while the l.v. switchboard is located at the back of the transformer cubicles. The transformer substations are of 14-in. brick-wall and concrete construction. The cable entries are sealed by a weak concrete mixture to prevent the entry of vermin, while in the transformer cubicles barrier walls are provided to prevent oil leakage from the cubicles in the event of serious faults.

**The transformer cubicles open out on the same side of the substation as the h.v. and l.v. switchrooms**

The h.v. switchgear in the transformer substations is similar to that in the main factory substations. In each of the h.v. circuit-breaker units there is a single ammeter which can be used on all phases by means of a selector switch. For closing the switch the spring is compressed by a hand-operated ratchet and can be either released by hand or solenoid, which thus facilitates remote operation for both closing and opening. Means are also provided on the switch for hand closing. For shunt tripping the transformer switches there is a 30-V nickel-iron battery with trickle-charging arrangements. In each substation and situ-

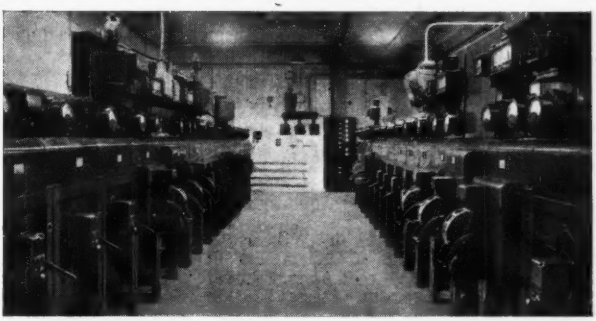
ated in the l.v. room there is a remote control panel with indicating lights for tripping or closing the h.v. switches.

While the capacities of the transformer sub-stations vary overall from 1,000 kVA to 3,000 kVA, the actual transformers installed are in one standardised size of 500 kVA. The transformers are British Electric Transformer equipments, and they are connected delta-star. They are equipped for off-load tap-changing. The tap-changing gear is electrically interlocked with the circuit-breaker on the h.v. switchboard to prevent mal-operation. The transformers are protected by over-load and earth-leakage apparatus on the h.v. side, and by overload release gear on the l.v. side. In addition there is intertripping protection between the h.v. and l.v. sides, so that in the event of the h.v. switch operating, the l.v. switch will trip and cannot be closed until the transformer has been energised from the h.v. side. The current transformers on the h.v. transformer switches have a 50 to 5 ratio.

An interesting scheme is provided for earthing the neutral at each end of the transformer stations, and in the earthing circuit there are links for testing purposes. In each case there are three 27-in. square plates disposed about a foot apart and bonded by angle-iron straps. On all the switchboards copper bonding strips are provided for earthing frames, and earth leakage-tests indicate a resistance value of 0·2 to 0·7 ohms.

Cabling from the transformers to the l.v. switchboards is carried out by 1·0-sq. in. p.i., l.c., single-core cables in the substation cable trenches. This switchgear is of the "Klad" type with 1,000-A carrying-capacity incoming transformer circuit-breakers, 1,200-A busbar couplers and 600-A outgoing feeder units. In each transformer circuit-breaker are incorporated a voltmeter, an ammeter and a kWh meter, while each of the feeder circuit-breakers has an ammeter with a phase-selecting switch. Each of the circuit-breakers, including the transformer units, is also provided with a terminal strip with potential and current transformer connections to facilitate the provision of additional meters. The current transformers on the incoming transformer circuit-breakers have a 800 to 5 ratio for protection and metering, while on the outgoing feeder panels they have a 600 to 5 ratio for metering only. Overload protection on the outgoing feeder units is provided directly by series coils and a plunger with a time-lag device giving from instantaneous up to 15 sec. time lags.

In a subsequent article the secondary distribution system will be described.



**In some cases the l.v. switchgear is imposingly set out in two facing lines**

## Fuel Efficiency

### Comprehensive Textbook

THE publication of a comprehensive text-book on "The Efficient Use of Fuel" under the ægis of the Ministry of Fuel and Power (807 pages; 303 illustrations. Stationery Office, 12s. 6d. net) indicates official recognition that the need for fuel economy is permanent. Originating in lectures and discussions held in connection with the present fuel-saving campaign, the work is claimed to have brought together in one volume matter to be found in perhaps twenty or more standard reference books. Intended primarily for students and technical men in industry, it has been prepared under the direction of the Education Sub-Committee of the Fuel Efficiency Committee of the Ministry. The general editor, Dr. G. E. Foxwell, has received the collaboration of more than 200 leading fuel technologists and each of the thirty-four chapters has been submitted to specialist panels for criticism.

In addition to information on the properties and utilisation problems of all industrial fuels, steam production (including boiler practice and testing) and measurements, there is given, it is said for the first time, a complete analysis from first principles of the flow of gases in a furnace system. A simple explanation of coal analysis for the practical man is another useful feature. Six chapters are devoted to furnaces including one of 17 pages on electric types. The final chapter discusses the selection of various fuels for industrial purposes. Three appendices deal with references to surveys of British coals, steam tables and entropy.

# Street Lamp Renewals

## Method of Estimating Probable Needs

**By J. C. Beard,** B.Sc., A.M.I.E.E.

A METHOD is here described by which lamp failures are analysed with reference to ages with the object of gaining reliable figures for use when estimating probable renewals.

It is reasoned that the number of failures in a group of lamps during any month is a function of the burning hours and a factor, dependent upon the age of the lamps, expressed as the "percentage failure per hour." Thus, if 100 sodium gaseous-discharge lamps are aged between 2,000 and 2,100 hours at the beginning of a month of 200 burning hours and, in that month, there are 10 failures, the percentage failure per hour for this group is $\frac{10}{100} \times 100 \times \frac{1}{200} = 0{\cdot}05$. Only analysis of extensive records can test the reliability of this reasoning. It is obvious that the greater the number of age groups, that is the smaller the duration of an age group, the more accurate the result. The limit in this direction is the arduousness of the task.

To compile the statistics in an accessible form a list is drawn up of all lamps from the individual records of each lamp standard which, it is assumed, are in existence and on which it has been the practice to date lamp replacements; from this information the age of all lamps and failures can be assessed by the use of a manufacturers' "lamp life calculator" or, failing this, a home-made chart as the one neatly arranged by Mr. F. H. Pulvermacher and illustrated in the *Electrical Review* of September 17th, 1943.

In the compilation the wattage is marked against each lamp (this is in case an analysis under the different sizes is required), vertical columns are drawn for each month and the age of each lamp at the beginning of a month is noted in the column for that month. At the end of the month the lamp ages are re-assessed by adding the monthly burning hours and so giving the figures in the next column. The burning hours of a lamp replaced during a month are readily obtained from the lamp life calculator or chart.

The method is illustrated in Table I. The hours in the January column are the ages on January 1st. By adding the 450 burning hours for January, the age figures to February 1st are given and these are entered in the February column. It is assumed that lamp No. 2 fails during February and that 180 is the age of the new lamp at the beginning of March.

TABLE I.—MONTHLY AGE ACCRETIONS

| Month | Jan. | Feb. | March |
|---|---|---|---|
| Dusk to dawn burning hours | 450 | 370 | 350 |
| Lamp number and wattage | Age, hr. | Age, hr. | Age, hr. |
| 1. 100 W | 100 | 550 | 920 |
| 2. 100 W | 1,000 | 1,450 (failed) | 180 |
| 3. 150 W | 0 | 450 | 820 |
| 4. 100 W | 2,000 | 2,450 | 2,820 |

From the list the lamps are segregated and totalled into chosen age groups and the total failures in the groups are related in the method shown above to give the "percentage failure per hour" for each group.

To show the method of application when estimating lamp replacement a sodium gaseous-discharge installation of 100 points is considered for December with 500 dusk to dawn burning hours. The age groups are arranged in 500-hour sections as shown in Col. 1 (Table II). Col. 2 gives the number in each age group. The percentage failures per hour shown in Col. 3 are based on observation. To arrive at Col. 4 the figures

TABLE II.—AGE COMPOSITION FOR MONTH (DECEMBER)

| 1<br>Age-groups hr. | 2<br>Composition at beginning of month | 3<br>Percentage failures per hr. | 4<br>Ratio of failures to installation | 5<br>Estimated failures during month | 6<br>Estimated age. composition at end of month |
|---|---|---|---|---|---|
| 0–500 | 10 | 0·01 | 0·05 | 1 | 29 (new lamps) |
| 500–1,000 | 7 | 0·01 | 0·05 | 1 | (10−1) = 9 |
| 1,000–1,500 | 22 | 0·005 | 0·025 | 1 | (7−1) = 6 |
| 1,500–2,000 | 37 | 0·05 | 0·25 | 10 | (22−1) = 21 |
| 2,000–2,500 | 22 | 0·12 | 0·6 | 14 | (37−10) = 27 |
| 2,500–above | 2 | 0·2 | 1·0 | 2 | (22−14) = 8 |
| | Total 100 | | | 29 | 100 |

in Col. 3 are multiplied by 0·01 to reduce percentages to ratios and by the number of burning hours for December to give the failures for the month. The failures in Col. 5 are the results of multiplying the figures in Cols. 2 and 4; where the products are fractions the higher integers are shown.

The age composition at the end of December or the beginning of January is re-assessed by adding the burning hours for December and moving into the new groups (if necessary) after subtracting the failures. I have simplified this example by adopting a month with the same number of hours as in an age group, but it will be understood that the age of each lamp in any group differs and that, in other months, lamps will not move equally into the next age group. The process can be carried on for a full year and the annual replacement estimated.

# Multiple Air Compressors

## Fault Protection and Load Allocation

**By G. McAuley**

WHEN installed, the plant here described consisted of four 130-HP two-stage rotary air compressors, each having a displacement of 700 cu. ft. per min. and delivering its output *via* a non-return valve to an air receiver. The latter consisted of a second-hand Lancashire boiler from which all internal steam pipes had been removed and of which the firebox openings had been welded solid. Its capacity was approximately 1,500 cu. ft., which was estimated to be sufficient to avoid an excessive number of starts per hour of the compressors.

From this receiver an air pipe was taken to a central control cubicle in which were located four pressure-gauge switches, so arranged that their contacts would operate at predetermined pressures. As each gauge was connected to its associated starter *via* a three-pin plug-and-socket outlet, any gauge could be connected to any starter to permit of load allocation.

### Protective System

On completion of the wiring and before any load was available (the original steam plant still being in operation), automatic fault protection and indication became the first consideration, primarily in order to safeguard the installation against any mechanical fault and, secondly, to supervise the human element. The second factor required considerable attention.

The protective system was grouped under three headings. The first and most important was that of water failure to the cooling jackets; the second was water temperature, taken at the portion of the water jacket adjacent to the main thrust bearing; the third was oil level, a check on oil pressure being impracticable with the type of lubrication system fitted.

The final rotor contactor on each starter has been modified to permit the switching of two additional sets of contacts, one for the protective system and the other for a signal back to the master-control cubicle. The following sequence was decided upon as offering the greatest security. Fault contacts operate, audible signal becomes energised, time-delay relay energises and commences its cycle of operation. At this stage, if the attendant switches the faulty machine from circuit or removes the fault, the only indication is that the appropriate fault relay has dropped and that the corresponding fault lamp has become illuminated, indicating that a fault exists on the machine to which it refers and that it has been promptly attended to. If, however, the attendant fails to isolate the machine before the time-delay relay completes its cycle of operation, this time delay will operate and shut down the entire plant. The trip will be recorded on a counting mechanism, and the fault light, indicating the reason for the shut down, will be switched on. The starting circuit of the faulty machine will have been opened, so that when the circuit-breaker is reclosed the machine cannot be restarted until its associated fault relay has been reset, involving the unlocking of the cubicle.

The importance of the above may be gauged by the fact that the maximum safe running time without water is two minutes. Since the only fuse in the protective system is also the fuse for the main circuit-breaker, any attempt to interfere with its working will only result in shutting down the plant. This was considered necessary in view of some of the ingenious methods encountered in the same works, whereby safety and interlocking devices were successfully by-passed to enable operators to apply larger loads than the normal.

### Revision of Load Allocation

It became increasingly evident, as further hammers were changed over, that a revision in the method of load allocation was necessary, as to ensure 100 per cent. load distribution was beyond the scope of the average switchroom attendant, quite apart from the consideration that as the duties became monotonous some errors would inevitably occur. Before any scheme was attempted, a careful check was taken on working conditions. This was greatly assisted by the installation of process timers, one on each start cubicle, to record the number of hours worked by each compressor.

Following this, sufficient time was allowed in order to estimate the diversity factor created by variations in the forged product handled. Three weeks proved adequate for this purpose, as a fairly accurate summary of working conditions was by then available. The data were grouped under three headings, *viz.*, prolonged light-load periods, diverse load (alternating between light and heavy) and sustained heavy load. One of the pressure gauge switches was adjusted to cut off at a pressure slightly in excess of the standard working pressure of 80 lb. per sq. in. This is termed the " sensitive pressure gauge."

### Load Allocation Sequence

The operation sequence of the load allocation unit is as follows:—When the sensitive pressure gauge makes contact on the low-pressure side, it will cause No. 1 machine to start, and to continue to run until the same pressure gauge makes contact on the high-pressure side, when the machine will shut down. In doing so it will cause the sequence switch to change the sensitive pressure gauge to No. 2 machine, so that the next time this gauge makes contact on the low pressure side, that machine will start up.

Assuming that the sensitive pressure gauge is connected to No. 1 machine, and that this machine is running, if the pressure continues to fall and the second pressure gauge makes contact on its low-pressure side, No. 2 machine will start up and then No. 3 and so on. Provided there are enough machines under these conditions to raise the pressure, then if the gauges are suitably adjusted, each machine will shut down in turn as its pressure gauge makes contact on the high-pressure side, but, not until the gauge associated with No. 1 machine makes contact on the high-pressure side, will the sequence switch step. This means that the compressor selected for the most sensitive gauge will function in a basic way and will run for fairly long periods, thus reducing the number of starter operations and compensating for pressure variations in the air receiver. Since each machine in turn is switched to function in this way by the sequence switch, the amount of work done by each compressor should be approximately the same.

Switches are provided to switch in and out each machine from the automatic sequence train, lamps indicating each of the above operations. Also, if the apparatus is switched out of circuit, this is recorded on counting mechanism, each operation requiring a corresponding entry in the log book.

I would express my thanks for the help given by the Automatic Telephone & Electric Co. in designing the switchgear called for by the scheme described, further details of which I should be pleased to supply to readers if required.

# Industrial Organisation

## Position of Trade Associations

A COMMITTEE appointed by the Federation of British Industries has submitted a report, which has been sent to the President of the Board of Trade, outlining what it considers to be the type of industrial organisation most suitable to this country's post-war needs. In the course of its deliberations the Committee, presided over by Sir Charles Bruce-Gardner (who has since been appointed Chief Executive for Industrial Reconversion), received written evidence from 130 associations.

The Committee considers that the ideal, from the national viewpoint, would be that the Government should confine itself to producing a framework of national economic policy, leaving the details to be filled in by the working associations provided by the industries themselves. Associations are needed which will be in a position to represent the views of, and formulate general production and commercial policies for, the sections of industry which they cover, in consultation with Government Departments and other authorities. They should also take the lead in improving and adjusting the organisation, both technical and commercial, of the sections concerned to meet the circumstances of the post-war world. To enable associations to be effective for this purpose it is essential that they should be the bodies to be taken into consultation by the Government. Such trade associations should be encouraged to place in the forefront of their objects not only service to their members and to consumers of their products, but also to the nation at large. As a general principle, membership of an association should not be compulsory.

Under peacetime conditions it is as a rule impracticable to separate home and export production without detriment to efficiency; trade associations and export groups should therefore be merged, or other adjustments made, so that there is only one body representative of the interests of any one section of industry for both purposes.

After detailing the functions of the kind of associations envisaged, the Committee states that there is room for closer co-ordination or federation of associations for certain purposes, and the formation of such federations or joint councils was an object that should be strongly encouraged.

Immediate post-war Governments are likely to desire to maintain closer oversight than in the past over arrangements and understandings, national and international, which involve temporarily controlling output, markets and/or prices. A method of achieving this which seems to have many advantages would be for the Government to set up a national tribunal to which bodies of persons substantially interested could appeal, and which would report its findings to the Board of Trade.

# Welding Load

## Effect on Supply Systems

A CRITICAL résumé of published information on the way in which energy supplied to resistance welding machines affects distributors of electricity is contained in an E.R.A. technical report* compiled by Messrs. R. B. GILES and P. SCHILLER.

Particular stress is laid on the means of improving the basically poor characteristics of this kind of load, which has never been attractive because of its demand (instantaneously large) for single-phase power at very low power and load factors. Betterment usually entails comparatively greater first cost and the report suggests that special tariffs, which compensate for the extra expenditure so involved, may prove to be an economically sound incentive.

Introductory general information is followed by brief comments on the kind of load imposed on supply mains by conventional resistance-welders. Measured inputs and power factors of single machines are tabulated as well as the calculated change for two or three machines (in groups of from three to twenty) operating simultaneously.

Network voltage drop is a matter of relative proportions; the permissible range of percentage fluctuation is comparatively small, but dependent upon its frequency of occurrence. The latter is the first factor to be ascertained, usually being least with butt and most with seam welding with a periodically interrupted circuit. The next consideration is the relative magnitude of the fluctuating load in respect of the total load on a particular section of the distribution system, or item of plant comprising it, which makes it evident that only relatively small resistance welders can be connected to general low-voltage mains without intermittently disturbing the distribution network. Therefore, since the cost of a distribution system is approximately inversely proportional to the percentage regulation allowable (reducing the regulation from 2 to ½ per cent. will increase the cost fourfold), it is claimed to be usually economic to apply special means of reducing the welding demand, as very briefly outlined in an appendix to the report.

Incidentally, tabulated results of practical tests show (provided the meters are not on the verge of creeping) that the accuracy of watt-hour registration of such intermittent loads is satisfactory, as is that of maximum demand indicators of the Merz-kW and thermal types.

Mains-disturbance problems arose much earlier in the United States than in other countries, causing special welding tariffs to be introduced. The specimens quoted in this report are by no means the product of any consensus of opinion; on the contrary, it is obvious that their bases vary considerably. No tariff based on the recently adopted nameplate standard appears as yet to have been published.

* Ref. K/T 110, price 7s. (postage 3d.); British Electrical and Allied Industries Research Association, 15, Savoy Street, London, W.C.2.

# Post-War Developments

IN opening a symposium on welding in British industry after the war, arranged by the Institute of Welding in London last week, MR. A. DYSON (joint managing director, Horseley Bridge & Thomas Piggott, Ltd.) surveyed developments which had taken place as a result of research during the war. He emphasised the need for welding engineers, designers and operators to receive adequate training in theory and practice.

MR. C. S. LILLICRAP (Director of Naval Construction) stressed the need for the shipbuilding industry to keep abreast of modern developments. He pointed out the unsatisfactory nature of composite riveted and welded work, and stated that Admiralty policy for warships was to attain practically 100 per cent. welded hulls as soon as possible. Directions in which research work was proceeding included the control of residual stresses, the welding of high tensile structural steels and X-ray radiology. Mr. Lillicrap emphasised the importance of proper planning and recording of welded work in the shipyard itself.

MR. H. N. PEMBERTON (senior surveyor, Lloyd's Register) reviewed developments in pressure-vessel construction, showing that much of the progress made in the design of steam generating plant and vessels for the chemical, oil and other industries had been made possible by the use of welding. The necessity for the proper laying-out and equipping of workshops was mentioned and the advances made in automatic welding processes were discussed, due recognition being accorded to the considerable progress achieved in the electrode industry.

Mr. Pemberton said that while it would be evident that the pressure-vessel industry had outpaced others in the extent to which welding was used for important stressed parts, there remained a large field for further development. It was important that British manufacturers should be in a position to compete on fair terms with manufacturers in other parts of the world. There was ample evidence based on experience and practical research to justify complete confidence in welded pressure vessels, provided they were made under a recognised code of manufacture.

DR. H. SUTTON (assistant director, materials research, Ministry of Aircraft Production), speaking with special reference to the aircraft

industry, dealt first with the welding of light alloys, for which he saw great scope in all forms of transport engineering, as well as in the food and chemical industries. Investigations were in progress to produce aluminium alloys with good general and working properties combined with good strength when welded and the outlook was promising. Gas welding was more extensively used than arc welding, but the latter had advantages and was likely to advance greatly, especially for the heavier gauge material. Castings in most of the common aluminium casting alloys could be welded to other parts, provided the procedure and especially the design were suitable.

Recent development work had opened up good prospects for the spot welding of dissimilar alloys and dissimilar thicknesses. Investigations of surface preparation of aluminium alloys for spot welding had established the superiority of chemical methods over mechanical ones. The speaker said that there were interesting possibilities in recrystallisation welding of aluminium.

Turning to the magnesium-rich alloys, Dr. Sutton spoke of the development of "Heliarc" welding in the U.S.A. and of argon-arc welding in Great Britain. Both dispensed with fluxes, the "pocketing" of which in the welding of the stronger magnesium alloys had caused much trouble in the past.

In conclusion, the speaker urged that there should be very great scope for welding in the fabrication or assembly of light alloy structures and articles, provided that suitable designs and procedures were employed. The welding engineer would bear the main responsibility for the performance of the product, and he must keep abreast of the latest advances and see that the light of his knowledge and inspiration fell upon the potential user, the design staff, the production organisation and the operators.

# Forthcoming Events

**Friday, November 3rd.**—*London.*—Institution of Mechanical Engineers, 5.30 p.m. "Stresses by Analysis and Experiment," by Prof. A. J. Sutton Pippard.

*London.*—39, Victoria Street, S.W.1, 6.30 p.m. Junior Institution of Engineers. "Design and Manufacture of Apparatus for Amateur Photomicrography," by L. S. Atkinson, M.I.E.E.

*Birmingham.*—Imperial Hotel, 6 p.m. Illuminating Engineering Society (Birmingham Centre). Debate: "That the Lighting of Class 'A' Roads by Stationary Lights is Necessary."

*Newcastle-on-Tyne.*—Neville Hall, 6.30 p.m. I.E.E. North-Eastern Students' Section. "Mutator Practice," by T. W. Berrie.

**Saturday, November 4th.**—*Manchester.*—Engineers' Club, 2.30 p.m. I.E.E. North-Western Centre. "Remote Switching by Superimposed Currents," by J. L. Carr.

**Monday, November 6th.**—*Birmingham.*—At James Watt Institute, 6 p.m. I.E.E. South Midland Centre. "Thermoplastic Cables," by Dr. W. Barron, J. N. Dean and T. R. Scott, D.F.C.

*Liverpool.*—Royal Institution, Colquitt Street, 5-30 p.m. I.E.E. Mersey and North Wales Centre. "The Design and Performance of Domestic Electrical Appliances," by W. N. C. Clinch and F. Lynn.

**Tuesday, November 7th.**—*London.*—Institution of Electrical Engineers, 7 p.m. London Students' Section. Chairman's address: "Notes on the Design and Manufacture of Impregnated Paper Insulated Power Cables," by C. C. Barnes.

*Birmingham.*—At James Watt Institute, 6 p.m. Electrodepositors' Technical Society (Midlands Branch). "Electrodeposition of Tin-Copper Alloys with special reference to Speculum," by S. Baier and R. M. Angles.

**Wednesday, November 8th.**—*London.*—Institution of Electrical Engineers, 5.30 p.m. Transmission Section. "Cable Terminations," by D. B. Irving.

**Thursday, November 9th.**—*London.*—Institution of Electrical Engineers, 5.30 p.m. Installations Section. "Electrical Accessories for Domestic Purposes; Some Notes on their Design and Installation," by F. C. Fuke.

*London.*—At Junior Institution of Engineers, 39, Victoria Street, S.W.1, 4.30 p.m. Association of Mining Electrical and Mechanical Engineers (London Branch). Presidential address.

**Friday, November 10th.**—*London.*—39, Victoria Street, S.W.1, 6.30 p.m. Junior Institution of Engineers. Informal meeting. "Electric Traction in Great Britain," by H. K. Hewett.

*Birmingham.*—Market Hotel, Station Street, 6.30 p.m. I.E.E. South Midland Students' Section. Informal dance.

*Manchester.*—Engineers' Club, 6 p.m. I.E.E. North-Western Centre Radio Group. "Development of Polythene as a High-frequency Dielectric," by Prof. Willis Jackson and J. A. S. Forsyth.

*Newcastle-on-Tyne.*—Neville Hall, 6.30 p.m. I.E.E. North-Eastern Students' Section. Direct-Current Machine Design," by L. B. Knowles.

*Bath.*—I.E.E. Bristol Students' Section. Paper by F. E. Marks.

**Saturday, November 11th.**—*London.*—Magnet House, W.C.2, 2.15 p.m. Institution of Engineers-in-Charge and Association of Supervising Electrical Engineers. "Some Applications of Electronics," by F. E. Henderson.

**Monday, November 13th.**—*Manchester.*—Engineers' Club, 6.30 p.m. I.E.E. North-Western Students' Section. "Recent American Hydro-electric Schemes with special reference to the Boulder Dam," by W. A. Hatch.

*Cardiff.*—At South Wales Institute of Engineers, 5 p.m. I.E.E. Western Centre. "Electrostatic Precipitation of Dust from Boiler-Plant Flue Gases," by J. Bruce.

*Newcastle-on-Tyne.*—Neville Hall, 6.15 p.m. I.E.E. North-Eastern Centre. "Organisation of Industrial Electrical Maintenance," by J. C. B. Nicol.

**Tuesday, November 14th.**—*Glasgow.*—Royal Technical College, 6.15 p.m. I.E.E. Scottish Centre. "An Analysis of the Load on a Modern Electricity Supply System," by P. Schiller.

*London.*—Lighting Service Bureau, 2, Savoy Hill, W.C.2, 5.30 p.m. Illuminating Engineering Society. "Bright Light Sources," by J. N. Aldington.

# Shannon Scheme

## Overhaul of Generating Plant

SOME of the troubles experienced and the maintenance required at the Ardnacrusha hydro-electric station of the Electricity Supply Board of Eire were described to the I.E.E. Irish Centre on October 19th by Mr. W. O'NEILL. In 1929 the station went into commission with three 30,000-kVA (0·7 power factor), 10·5-kV generators driven at 150 RPM by Francis vertical turbines.

In April of last year the first of the generators was taken out of commission for overhaul on account of eddy-current heating in the stator core. This defect was due to deterioration of paper layers between laminations and rusting of laminations caused by moisture in cooling air which prevented the generators being fully loaded. This resulted in serious loss of efficiency, since the efficiency of a Francis turbine with fixed blades falls rapidly with decrease of load as compared with a turbine of the Kaplan type, in which the blades are adjustable to varying water flow, permitting relatively high efficiency at part load, *e.g.*, 86 per cent. at one-third load as against 70 per cent. for the Francis type. The no-load water consumption of the Francis type is approximately three times that of a corresponding Kaplan machine, being sufficient to generate about 4·5 MW by the latter.

The overhaul included the removal of all (about 58,000) laminations, those showing excessive rust being replaced and the remainder cleaned and re-insulated; the increase in the number of air ducts in the core from 21 to 31, with corresponding reduction in size to maintain the same depth of iron; and the removal of the four quadrant joints. The last entailed scrapping the half-laminations and interleaving full laminations at the joints in the frame as in other parts of the core, thus making the core one piece. At the same time, the air-cooling system was altered to one of the closed-circuit type.

No indication of deterioration had become evident during the twelve months since the overhaul was completed, and the maximum steady temperature was 25 per cent. below previous values. The complete dismantling of the first machine down to the stator frame took 3½ weeks, rebuilding of the core 4½ weeks, erection of the coils (including binding and soldering) 4 weeks and reassembling, drying out and testing (excluding the heat run) 2½ weeks. The complete job took, in all, 16½ weeks and the cost was approximately £4,000. The two other generators required 4½ and 6 months.

# Radio Aerials

## Theory and Measured Performance of Transmitting Arrays

ONE of two papers submitted at the same meeting in London of the Radio Section of the Institution of Electrical Engineers opens with the argument that the construction of a highly directive aerial system is dominated by the difficulty of providing the necessary feeding cables.

Continuous reflecting sheets are employed as a device for reducing the number of feeder cables required and the use of corner reflectors is suggested in the paper by DR. E. B. MOULLIN (Metropolitan-Vickers Electrical Co., Ltd., and Oxford University), consisting of a pair of sheets inclined to one another to form a "V" with a single aerial on the bisector, more especially because the field would be known everywhere if the sheets extended to infinity, for the field of an aerial in a "V" can be calculated by image treatment and an algebraic formula for the diffraction pattern can be found when the angle of the "V" is a proper fraction of 180 degrees.

Dr. Moullin shows that such an algebraic expression can be expanded in a Fourier series in a manner that is of practical value, since it conveniently saves much laborious computation. The second part of his paper describes an experimental comparison of the observed and ideal patterns and his investigations have shown that the pattern is not modified appreciably by amputation of the apex of the "V" and closing the resulting hole with a flat sheet, thus saving space and also indicating that the pattern is insensitive to the shape of the back of the reflector.

It is therefore not necessary to construct "V" reflectors to close tolerances of manufacture and, moreover, the optical concept of the advantage of a concave mirror does not apply when the source is distant only some $\frac{1}{4}\lambda$ from it. The pattern is insensibly affected by replacing continuous sheets by wire netting whose mesh has a side of about $\lambda/40$, while sheet replacement by a comb of open rods about $\frac{1}{4}\lambda$ long does not cause any appreciable detriment.

The other paper submitted at the same meeting, for which MR. H. PAGE (B.B.C.) was awarded the Coopers Hill War Memorial prize and medal, compares the measured and theoretically ideal performances of horizontal dipole transmitting arrays on typical short-wave broadcasting frequency bands.

Measurements were made by means of an elevated calibrated frame receiving aerial attached to a captive balloon as well as a frame aerial at ground level. They show good agreement between theoretical and measured performance. When radiation is over a flat site free from obstacles, the maximum field strength is of the order of 0·8 to 0·9 of the theoretical value. But a sloping site or radiation through other nearby arrays may cause appreciable departures from the theoretical characteristics.

An array without a reflector curtain covers the particular frequency band concerned without appreciable loss of radiation efficiency, which is also true for an array with a parasitic reflector curtain that is tuned to the working frequency. If, however, the reflector is tuned always to the mid-band frequency, the radiation efficiency at other frequencies will be reduced. The band-width can be increased by reducing the characteristic impedance of the dipoles, and measurements have been made on two types, one consisting of single wires and the other of two parallel wires spaced 6 in. apart. For an array of four rows of single-wire dipoles, the band-width is $\pm 1$ per cent. for a 10 per cent. drop in field strength relative to the mid-band frequency; for a similar array of two-wire dipoles the corresponding band-width is $\pm 2$ per cent. The band-width of arrays containing less than four rows is approximately the same.

# Flue-dust Precipitation

## Experience at Tir John Station

ELECTROSTATIC precipitation of dust entrained by flue gases produced from the combustion of pulverised anthracite duff in power station boilers is dealt with in a paper prepared by MR. JOHN BRUCE (John Bruce & Staff) for the Institution of Electrical Engineers.

The author is indebted to Mr. H. E. Blackiston (Swansea Corporation Electricity Department) for permission to use data and the inclusion of other relevant information in his paper, which describes field-scale experiments and outlines the results of pilot-scale tests. In addition the salient features and general arrangement of a large-scale commercial installation are described together with some of the operating results obtained therefrom.

The three groups of precipitators for three boilers, each of a capacity of 230,000 lb. (m.c.r.) of steam per hour, are similar in all respects. The electrodes of the inlet banks are energised at 40 to 45 kV and those of the output banks at 45 to 50 kV, or over. The total power consumed by the rectifier and precipitator equipment, including rapping-gear motors and ventilating plant, is 3 to 3·5 kWh per million cu. ft. of gas treated, of which from 2·5 to 2·7 kWh is absorbed in the electrode-field zone.

Two-thirds of the plant has been in service sufficiently long to reveal its performance and indicate its ability to deal effectively with flue dust from anthracite duff. With that particular kind of fuel the precipitator must be provided with means of efficiently trapping and extracting partly ionised carbon particles which, although influenced to some extent by the electric field, might otherwise remain in the gas stream or creep close to the collector electrodes and so escape. Provided such means are incorporated, then the efficiency of electrostatic precipitation can be high; but it will be adversely affected if a high degree of fineness of grinding and high combustion efficiency are not maintained continuously in combination.

The author complains of the lack of comprehensive knowledge of the influence of all the factors governing the design of electrostatic precipitation plant. Very little investigatory work has been done on commercial installations with the object of establishing design constants which, in turn, might reduce the size and hence the capital cost of commercial plant. Electrostatic precipitators have been installed at a number of powes stations throughout this country; the author is convinced that collaboration between their users, manufacturers and research staffs would prove to be most useful.

For instance, it seems that precipitators need to be provided with means of controlling the mass flow of the gas so that each parallel electrode field shall be furnished with an equal volume of gas under all load conditions and also to ensure that the velocity in each shall be uniform throughout its cross-section. But commercial designs do not incorporate any such means of adjustment. The author has no doubt that part of the erratic and unaccountable behaviour of commercial-scale plant (apart from "birdnesting" and back ionisation) is due to unequal gas velocities and non-uniform distribution of dust within the gas, which result in concentrations for which the plant was never designed.

## Blast-Furnace Operation

THE autumn meeting of the Iron & Steel Institute on November 23rd and 24th, will be devoted to a discussion on blast-furnace operation and problems. The meeting will be held in London at the Institution of Civil Engineers. On the first day there will be sessions at 11 a.m. and 2.45 p.m., and on the second day one session commencing at 11.30 a.m.

# PERSONAL and SOCIAL

## News of Men and Women of the Industry

A KNIGHTHOOD has been been conferred upon **Brigadier Bruce Gordon White,** M.B.E., for the part he played in designing and producing the portable harbours employed in the Normandy landings. Brigadier White is a civil engineer, and a director of the B.E.T. Electricity Supply Co., the National Electric Construction Co., the Antrim Electricity Distribution Co., and the Antrim Electricity Supply Co. He is a member of the Institutions of the Civil, Mechanical and Electrical Engineers.

Another electrical man associated with the design of the equipment of the portable harbours is **Lieut.-Comdr. Robert A. Lochner,** R.N.V.R., A.M.I.E.E., who was for a few years with Crompton Parkinson, Ltd., and later with Laurence, Scott & Electromotors, Ltd. He was also largely responsible for the development of the degaussing gear used as a protection against magnetic mines.

During a civic reception held by the King and Queen at Dover last week, **Mr. R. G. Widgery,** the borough electrical engineer, had the honour of being presented to Their Majesties.

**Mr. D. J. Bolton,** M.Sc., M.I.E.E., has resigned his membership of the London and Home Counties Joint Electricity Authority. Mr. Bolton joined the Authority towards the end of 1937 and had been vice-chairman of its Local Distribution Committee since 1941.

As is mentioned in a leaderette in this issue, the Council of the Electrical Development Association considers it desirable to appoint a director-general of the Association, and **Mr. V. W. Dale,** who has been assistant director and secretary since March last year, is to be general manager and secretary.

**Mr. V. W. Dale**

Mr. Dale has taken a major part in the Association's work since its inception when he left the service of West Ham Corporation to join his chief, Mr. J. W. Beauchamp, the first director of E.D.A. During his long and arduous period of service Mr. Dale has become one of the best-known men in the electrical industry, particularly by reason of his activities in the organisation of exhibitions all over the country. The war has imposed additional burdens on him and his depleted staff, but together they have kept the electrical development idea well to the front, in spite of its being coupled with the need for economy.

**Mr. R. L. Batley,** resident engineer of the London Passenger Transport Board's Neasden generating station, has been appointed generation engineer at the Tir John power station, Swansea. Mr. Batley, who is forty-four, received his secondary education at Southport and later studied at Liverpool University, Bradford Technical College and the Regent Street Polytechnic. After a five-year mechanical engineer. ing apprenticeship at the Cunard Engine Works, Bootle (interrupted in 1918 by nine months' service as pilot, R.A.F.), he was in 1922 appointed marine engineer with the Cunard Steamship Co. In 1929 he went to Bradford as steam engineer and relief shift engineer at the Valley Road power station, leaving in 1932 to become boiler house engineer at the Millfields Road power station, Hackney. He went to Neasden in 1933 as boiler house superintendent, being appointed assistant resident engineer in 1937 and resident engineer in 1941. Mr. Batley is a member of the S.E. Regional Fuel Efficiency Committee

**Mr. E. Hywel Jones**

**Mr. R. L. Batley**

of the Ministry of Fuel and Power, and is joint author of a book on "Boiler House Technology" (Pitman).

Mr. Batley succeeds **Mr. E. Hywel Jones,** who, as announced last week, has been promoted to the position of deputy chief electrical engineer. Mr. Jones only recently joined the Swansea undertaking, having previously been at Liverpool, where, in consequence of his resignation, the following re-arrangement of staff has taken place:—**Mr. J. P. Wotton,** B.Eng., assistant station superintendent at the Lister Drive power station, has been appointed to a similar position at the Corporation's Clarence Dock station; **Mr. F. V. Evans,** senior shift engineer, and **Mr. A. F. Harper,** assistant shift engineer, at Lister Drive become assistant shift engineers at Clarence Dock; **Mr. A. W. Dean,** assistant shift engineer at Lister Drive is promoted shift engineer; and **Mr. S. J. Bailey** and **Mr. J. Gillet** assistant shift engineers at Clarence Dock become assistant shift engineers at Lister Drive.

At a special meeting last week the Stirling Town Council considered the situation created by the decision of Mr. Norman M. Hunt, Dumfries, not to accept the appointment of burgh electrical engineer. Provost Gourlay and other members suggested the appointment of the second man on the short-list, **Mr. Colin M. Mundie,** Castle Douglas, but a section of the Council desired that the matter should be referred back to the Electricity Committee to explore by communication with the Electricity Commissioners the question of some form of temporary supervision until times were more propitious to appoint the type of man required, provided the Council was then in possession of the undertaking.

In the course of the discussion the view was

expressed that regionalisation of some kind would take place, and it might be that the Council would never need to make a permanent appointment. Finally Mr. Mundie's appointment was agreed to. The post carries with it a salary of £537, rising to £632 per annum. Mr. Mundie is a Falkirk man, thirty-nine years of age. After education at the Falkirk High School and the Royal Technical College, Glasgow, he served an apprenticeship with Carron Company and from 1925 to 1928 was a technical assistant with the company. He then took up a similar position with Thermotank, Ltd., and later was electrical engineer with G. & J. Weir, Ltd., for two years. He joined the North-Eastern Electric Supply Co. in 1932 as senior assistant engineer at Carville and a year later went to the Galloway Water Power Co. as clerk of works. He subsequently became resident engineer in charge of the Glenlee, Earlstoun and Carsfad hydro-electric stations. Mr. Mundie holds the diploma of the Royal Technical College and is an associate member of the I.E.E.

The following were elected to the general council of the British Institution of Radio Engineers at the recent annual general meeting: Messrs. P. Adorjan (Rediffusion, Ltd.), J. W. Ridgeway (Edison Swan Electric Co.), H. Brennan (Universal Relay), Lt.-Col. F. Taylor (War Office), T. D. Humphreys (A. C. Cossor) and M. M. Levy (Standard Telephones & Cables). **Mr. G. A. V. Sowter** (Telegraph Construction & Maintenance Co.) has been elected chairman of the Council.

**Mr. G. W. Mitchell,** mains superintendent to the Hull Corporation Electricity Department, was recently presented by Councillor T. R. Broadbent, chairman of the Electricity Committee, with a certificate to commemorate the completion of twenty-five years' service in the Department.

On the completion of twenty-one years as secretary of the London Chamber of Commerce, **Mr. A. de V. Leigh,** M.B.E., has been presented with a cheque for £2,260 and a book containing the names of the 2,260 subscribers each of whose subscriptions was limited to £1. The presentation was made at the Caxton Hall, Westminster, by Mr. J. McLean, chairman of the Council, in the absence through illness of Major-General Sir Evan Gibb, President of the Chamber.

**Commander Sir Charles Craven,** has been elected president of the British Employers' Confederation in succession to Sir Harry F. Brand, who had held the office for the past five years.

**Mr. J. E. Coode,** chief commercial assistant with the St. Pancras Electricity Department, is retiring at the end of the year, when he will have completed just over forty years' service.

The G.E.C. Dramatic Society staged Frank Vosper's "Love from a Stranger" in the theatre at Magnet House, Kingsway, during the week ended October 14th. The players taking part were :—Constance Needham, Jean Freeman, Elsie Walbancke, William Peacock, Robert Sutton, Edgar Penwarden, Joan Marshall, and Robert Scutt. The play was produced by Dorothy Fox and the settings and stage direction were by Lewis A. Foster who was ably assisted by other members of the Magnet House staff. As a result of the Society's efforts, the G.E.C. Well-Wishers' Club (which sends parcels to members of the Magnet House staff now in the Forces) will benefit by £160.

**Appointments Vacant.**—Among the vacant positions advertised in this issue are the following:—Manager of the Hull telephone undertaking (£1,000-£1,200); deputy electrical engineer, Colchester (£643-£744); boiler house superintendent (£642-£673) and mechanical maintenance engineer (£583-£612) for Swansea; assistant station superintendent, Luton (£503-£537); technical assistant, West Midlands J.E.A. (£600); lecturer in electrical engineering, R.A.E. Technical School, Farnborough (£400-£600); and lecturer in the Engineering Department, Sunderland Technical College (£234-£480, plus bonus).

## Obituary

**Professor C. G. Barkla.**—We regret to report the death on October 23rd, at the age of sixty-seven, of Dr. Charles Glover Barkla, Nobel Laureate, D.Sc., LL.D., F.R.S., Professor of Natural Philosophy in the University of Edinburgh. Educated at Liverpool Institute, University College, Liverpool, and Trinity and King's Colleges, Cambridge, he was in 1902 appointed Oliver Lodge Fellow in the University of Liverpool, in 1905 demonstrator and assistant lecturer in physics, and in 1907 lecturer in advanced electricity. He went to London University (King's College) in 1909 as Wheatstone Professor of Physics. He was elected a Fellow of the Royal Society in 1912, was Bakerian Lecturer in 1916 and Hughes Medallist in 1917. In the course of research work he made several important discoveries in connection with X-rays and their polarisation and he prepared many papers on electric waves, X-rays, etc.

**Mr. H. W. Healy.**—We learn with regret that Mr. H. W. Healy, former managing director of the Parnall Aircraft Co., Ltd., died on October 26th, at Stoke Mandeville, Bucks, after a short illness. Mr. Healy, who began his industrial career at the old Battersea power station, founded the Association of Power Engineers. A number of small but important patents gained for him at an early age a reputation as an engineer of outstanding ability with a fresh and original mind. He joined the Gramophone Co., of which he later became general manager, and was a pioneer in radio and television in many countries, particularly Spain, Turkey and India. He joined the Parnall Aircraft Co. in 1936 and resigned his position as managing director in 1943.

**Mr. R. Barrington** and **Mr. S. Brookes,** representatives of Redfern's Rubber Works, Ltd., have both died recently after short illnesses.

**Mr. F. J. Lock.**—We regret to learn of the recent death at the age of sixty-nine of Mr. Frederick John Lock, proprietor of the Taunton electrical contracting firm which he founded in 1903.

**Mr. J. C. Taylor.**—The death occurred at Woking on October 26th, in his seventy-third year, of Mr. John Charles Taylor, M.Inst.C.E., M.I.E.E.

**Wills.**—**Mr. Edwin Seddon,** late city electrical engineer and manager, Edinburgh, left estate amounting to £14,076.

**Mr. E. G. Byng,** a director of the General Electric Co., Ltd., left £295,934 (net personalty £264,250).

# CORRESPONDENCE

*Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.*

## Prevention of Accidents

IN reply to Mr. F. G. Cherry's letter in your issue of October 13th, I give briefly the two examples I had in mind.

(1) A passenger lift having two open sides provided with gates without interlocks. This lift frequently goes out of operation and I have known the passengers to climb out through a 2-ft. aperture. At least two of the lift attendants have been hurt with trapped hands.

(2) This building contains the goods lift to which I referred in my earlier letter. The electrical interlocks on the landing gates have long since ceased to function. Some wires must remain as over a long period the opening of the street gate was fraught with much interest and daring owing to the fact that more often than not the gate (in a public street) was alive. Possibly owing to corrosion this feature has not been in evidence lately.

The passenger lift in the same building has no operative interlocks on either cage or landings. I know of only one accident in three years, when a fireguard stepped through the open gates.

The Factories Act, 1937, Part XLV, Sec. 151, defines " factory " and I take the vital words to be " within . . . the precincts of which persons are employed in manual labour in any process for . . . (a) the making of any article or of any part of any article." In my opinion such a definition is applicable to the conditions existing in the building in question. The Superintending Inspector of Factories stated that he was informed " that the lift . . . is not within the scope of the Factories Act and hence does not come within my jurisdiction." As to insurance, may I ask why it was necessary to make motor insurance compulsory when it is a much smaller risk?

*Liverpool.* E. W. ASHBY.

## Domestic Plugs and Sockets

TO correct a possible misconception in the minds of your readers, I feel it advisable to state that discussions are still proceeding between the Ministry of Works Electrical Installations (Study) Committee and representatives of the appropriate section of the B.E.A.M.A. on the design of the new standard general purpose socket-outlet and plug, which is proposed in the Appendix of the Report of the Committee (Post-War Building Studies No. 11: Electrical Installations, p. 87), and to which reference is made in paragraph 142 of the " Housing Manual, 1944 " recently issued by the Ministries of Health and of Works. No proposals have yet been passed to the British Standards Institution.

As has already been made clear by the Director of the British Standards Institution in a letter which appeared in your columns on July 14th last, it is incorrect for references to be made to the present availability of a " standard " plug and socket, as the exploratory discussions are not yet concluded. In the meantime the only three-pin British Standard plugs and sockets are those which conform to existing British Standard Specifications. A statement on the outcome of the discussions will be made at the appropriate time. W. K. BRASHER, *Secretary*,

*London, S.W.*1. M.O.W. Electrical Installations (Study) Committee.

IN your issue of October 20th, Mr. Alex. Milne states that the 2-A outlet cannot be ignored as it is a very useful accessory for radio or bell circuits. In this connection, it may be useful to draw attention to the fact that special plugs and socket outlets have been standardised for radio and bell circuits which are not connected to the supply mains. The specifications concerned are B.S. 666, Inlet and Outlet Connectors for Radio Circuits and B.S. 732, Inlet and Outlet connectors for Bell Telephone and Similar Circuits. P. GOOD, *Director*,

*London, S.W.*1. British Standards Institution.

## An Industrial Aspect

MR. R. BENNETT is quite right to point out in your issue of October 20th that steps should be taken to prevent plugging low-voltage apparatus into standard-voltage sockets. On the other hand why not use standard apparatus and standard plugs by employing the method of earth-leakage protection described by Mr. F. E. Butcher in the *Electrical Review* of July 11th, 1941? This scheme enables 230 V, AC, to be used safely and also incorporates a transformer which is a desirable feature in the low-voltage systems. While 50 V is fairly safe, without earth-leakage protection, there may be still a risk of sufficient shock to cause a man momentarily to lose his balance and possibly sustain serious or fatal injury. Few of the low-voltage systems cover this feature and, therefore, as the scheme described for 230 V covers the passing shock danger, there seems no necessity to introduce further alternative voltages and types of plugs.

The subject should, however, be brought up for discussion with a view to introducing regulations covering a standard for industrial and domestic appliances at the same time. Sufficient use has been made of the Butcher-

Black & Decker scheme in industrial concerns to enable its advantages to be examined and demonstrated under operating conditions and there is no reason why it cannot be extended to domestic installations. The expense of a transformer is not always liked, but wider use could cheapen production and would probably prolong the use of apparatus and lamps connected to a degree which may not yet be realised.

*London, E.C.*4. P. F. GROVE.

MR. R. BENNETT'S letter in your issue of October 20th raises a very interesting point. The risk mentioned, however, could I think, be safely overcome by ensuring that all the outlets on the 220- or 230-V system were three-pin type and all on the 25- or 50-V two-pin. The use of three-pin plugs is hardly necessary on circuits of 50 volts or under.

Regarding the domestic aspect, the majority of contractors in this area (which is strongly E.C.A.-minded) favour the ring main and fused-plug system. The amateur electrician mentioned by Mr. Milne will, I am afraid, be always with us and any system, no matter how apparently foolproof, will be subject to " improvements " by his willing hands, so it boils down to the fundamental fact that the best system is that which gives the householder the maximum number of outlets with the greatest measure of safety and convenience consonant with the lowest cost per point.

*Hull.* H. B. SCAIFE
(British Thomson-Houston Co. Ltd.).

## Freedom of Choice

AS a side issue to the storm which has arisen from Mr. Murphy's letter there is, after all, something to be said against the solid hotplate. It is slow, inconvenient and has not improved the temper or liking for electricity of those who have to wait and don't like waiting. Cooling off means nothing to them. Super-speed is not really necessary, but just something which will attain full heat fairly quickly. What is perhaps more important is that heat should be lost equally quickly and thus permit simmering on a lower range of easily regulated heats at consistent temperatures. This is essential and saves frequent and vexing visits to the cooker by the busy housewife.

My own cooker for the past five years has been fitted with the ideal and trouble-free arrangement of a 2-kW fast plate (which needs no special utensils) with a ten-heat control by auto-transformer so that full voltage is applied only during the comparatively short periods of full heat. Not only does this lengthen the life of the plate but it also gives ideal boiling and simmering facilities.

A similarly controlled grill allows waiting dishes to be kept at just the right temperature without the food becoming a burnt offering or getting cold. With a thermostatically controlled oven this cooker, which is a standard pre-war model, will compete with all comers. I hope to see many more fitted this way and so improve the goodwill of electricity for cooking.

*Chichester.* H. E. TAUNT.

## Technical Indexing

I NOTE from the British Standards Institution Handbook that the Institution will shortly be issuing the electrical section of an English edition of the universal decimal classification system, and no doubt many engineers will take the opportunity to put their technical indexing system on a common footing. However, unless some information is given on " shelf arrangement " and a comprehensive alphabetical subject index included, the system will lose a lot of its value to the already overworked engineer.

Unfortunately, a thorough understanding of the system with all its sub-divisions, form classifications, auxiliary tables, etc., is necessary in order to classify subject matter and I consider it would be preferable if all technical journals and the technical Press indexed and cross-referenced all articles, if necessary accepting orders for printed index cards, so relieving the individual of a great deal of work and in addition ensuring uniformity of classification.

I believe that in America printed index cards are supplied with newly published textbooks, and in this country the *Post Office Electrical Engineers' Journal* has for some time given classification numbers in the headings of technical articles.

There is obviously a need, for so many other countries have already adopted some such system, and as the mass of technical literature published is not likely to become less, the present time seems opportune for the adoption of a national standard system of classification. F. E. DUFFIELD

*Birmingham.* *Librarian,*
I.E.E. South Midland Centre.

## Domestic Electrical Training

AT a meeting held in Glasgow on October 26th by the local branch of the Electrical Association for Women the Earl of Airlie, chairman of the North of Scotland Hydro-Electric Board, said that they proposed to proceed with a definite scheme for the training of girls in the proper use of electricity in the household. It was the intention to send young women from the Highlands to domestic science colleges where they would gain a proper insight, not only into domestic economy, but into the scientific methods of cooking by electricity. They would also be trained in the use and maintenance of electrical apparatus, after which they would be put in charge of districts.

# Lincoln Inquiry

## Electricity Commissioners' Decisions

AN inquiry into an application by Lincoln Corporation for permission to extend its St. Swithin's power station, including the erection of two cooling towers, was held by Sir Cyril Hurcomb and Sir Leonard Pearce, Electricity Commissioners, accompanied by Mr. G. L. Pepler (of the Ministry of Town and Country Planning) on October 4th and 5th. (See *Electrical Review*, October 13th, p. 531.) We have now received from the Electricity Commissioners a copy of a letter which they have sent to the Lincoln Corporation setting forth their conclusions in this matter which have the concurrence of the Minister of Town and Country Planning.

The first part of this deals with the evidence given at the inquiry for and against the proposals. The Commissioners state that there has already been considerable industrial development in the area concerned and further development is anticipated. The principal objections were to the cooling towers. The chief engineer of the Central Electricity Board had said that the Board had provisionally in mind a future major generating station somewhere on the Trent, but it was considered necessary and economical to extend the Lincoln station rather than to proceed with the first stage of the new station.

### Well-Placed Station

Although they do not necessarily accept the estimates of comparative cost given at the inquiry, the Commissioners are satisfied that it would be wasteful not to extend the Lincoln station which is well placed for the purpose. They would not therefore feel justified in refusing consent to the extension, subject to suitable safeguards and conditions which would entail important modifications in the proposals submitted.

As regards the cooling towers, the Commissioners agree that their height (230 ft.) would interfere with the view of the Cathedral and ornamentation would not remedy this. They reject alternatives propounded at the inquiry, but consider that it would be possible to introduce wooden towers not more than 90 ft. or so high—which is the proposed height of the station building—and there should be space for the necessary number, possibly by reducing the accommodation for coal stocks.

In connection with the contention that there would be excessive precipitation from the towers, the Commissioners consider that if they are not overloaded this should not happen. They suggest, however, that the distance between the circulating water intake and outlet points should be further considered with a view to utilising to the best advantage the stretch of river to be used in effect as a cooling pond.

Within the height limit of 90 ft., which is commonly accepted for such buildings in planning schemes, the Commissioners have no doubt that a replanned and extended station could provide a more satisfactory and attractive industrial building than the present station. Two proposed chimneys were to be 279 ft. high to minimise the effect of any emissions, but the Commissioners think that this height could be reduced to 225 ft. without adverse effects upon the station's efficiency. The usual precautions against smoke and grit emission would be imposed.

### Adequacy of Condensing Water

The principal objectors contended that there would not be an adequate supply of condensing water for the station and the Commissioners, before issuing their formal consent to the plans, will require to be satisfied on this point. Subject to this and to their being satisfied as to the intended layout of the station and the site as a whole the Commissioners are prepared to sanction an extension of the site and the installation of a second 20,000-kW set, with the necessary building and civil engineering work and cooling towers.

The consent will require the Corporation to submit drawings of the station and site, after seeking the advice of the Royal Fine Art Commission as to the architectural design of the buildings; to restrict the height of the chimneys to 225 ft., and that of the station building and the cooling towers to 90 ft.; and to agree to use continuously the most efficient means of preventing the emission of smoke and grit and for avoiding any nuisance in the working of the station.

The new set, together with the existing plant and a set already sanctioned but not installed, will raise the capacity of the station to 50,000 kW. The chief engineer of the Central Board stated at the inquiry that the ultimate development might be restricted to 60,000 kW, but, the Commissioners say, any extension to this would require a further consent.

---

## Grass Drying

A CONFERENCE on grass drying is being held on November 14th at the Institution of Mechanical Engineers, Storey's Gate, S.W.1, by the Chemical Engineering and Agriculture Groups of the Institution of Chemical Engineers. The conference opens at 2 p.m. with the presentation of three papers which will be open for discussion at 4.15 p.m., after the tea interval.

# COMMERCE and INDUSTRY

## Quality Control Method. Domestic Fuel Installations.

### Municipal Trading in Belfast

BELFAST Corporation Electricity Committee has passed a resolution, by four votes to three, recommending the Corporation to seek power in the next Bill to be promoted in the Northern Ireland Parliament to sell electrical apparatus to its consumers and to carry out repairs.

### Lighting Fittings Price Increase

The Electric Light Fittings Association announces that in consequence of increases in cost of production, it has been found necessary to increase the current wartime advance on commercial type and decorative type fittings, whether sold with English or foreign glassware or without glassware, to 50 per cent. on prices ruling at September, 1939. The same advance will also apply to glassware when sold separately from the fittings.

### Portuguese Telephone Inquiry

The Portuguese Minister of the Interior has ordered an inquiry into the wages and conditions of work of the employees of the Anglo-Portuguese Telephone Co., the British-owned company which has a concession for telephone systems in Lisbon and Oporto. Recently, a similar inquiry was ordered in connection with the British-owned Lisbon Tramways.—*Reuter.*

### Q.C. by Limit Gauging

Most engineering works producing individual parts in relatively large quantities use a limit-gauge system of inspection and are, therefore, sometimes reluctant to apply normal quality control by measurement, involving the purchase of measuring equipment and the training of personnel. An alternative form of quality control employing limit gauges has recently been developed for such cases.

This alternative form is also useful where quality control by measurement is impracticable, such as in the machining of very small components, when accurate measurements under shop conditions may be difficult, or the dimension may not lend itself readily to checking, other than by "go" and "not-go" gauges, or personnel is lacking with the necessary skill to take and record measurements, calculate averages andplot results on a chart.

Quality control by gauging will also serve those firms who possess machines that are generally able to produce articles well within the drawing tolerances, allowing a margin for variation in setting. This alternative system is not intended generally to supplant quality control by measurement, which is still regarded as the ideal system. An article in the October issue of the *Production & Engineering Bulletin* of the Ministries of Labour and Production explains fully how quality control by gauging may be applied.

### Insulating Board Prices

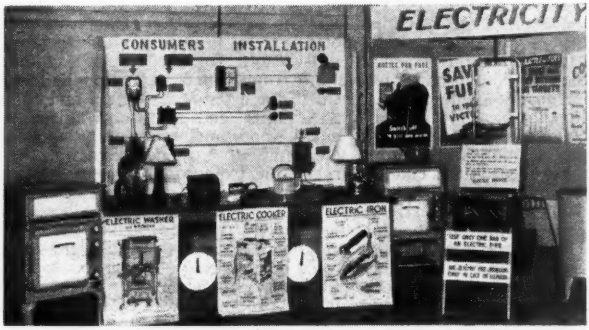
The Control of Paper (No. 65) Order, 1944 (S.R. & O. 1944, No. 1153) provides for decreases in the maximum prices for electrical insulating board.

### Summary of Wartime Regulations

New and amending regulations issued up to September 30th last are included in an eighth supplement just published to the "Summary of Emergency Statutes, Regulations and Orders Affecting the Electricity Supply Industry." The index includes Supplements IV and VIII (which together supersede all previous issues) and this forms a complete guide to wartime regulations which concern the industry. Matters received too late for inclusion in the main body of the supplement are dealt with in an addendum. As before, the supplement (price 2s. 6d.) has been compiled by Messrs. Leslie Gordon and J. W. Simpson, assisted by Mr. F. Newey.

### Maintaining Consumers' Goodwill

Before the war an important part of the work of electricity undertakings was that of maintaining good relations with consumers. Under wartime conditions it has not been possible to carry out all the former activities, but efforts have nevertheless been made to keep alive the good feeling existing. The London Electric Supply Corporation, Ltd., has sent us details of what it is doing in this direction.




**Exhibition arranged by the London Electric Supply Corporation, Ltd.**

In co-operation with the L.C.C. South-East London Technical Institute a food advice bureau was opened at the company's Lewisham showrooms for "Domestic Front" purposes, supported by topical advertisements in the local Press and a display of the Ministry of Food's posters. Cooking demonstrations, discontinued

when the premises were partially destroyed by enemy action, were subsequently recommenced and have since been well attended. Classes principally devoted to "make do and mend" have been held in conjunction with the L.C.C.

The problem of even simple repairs to domestic installations and accessories having grown acute, the company has endeavoured to assist consumers in the carrying out of simple repairs and replacements. Special classes composed of A.R.P., W.V.S., etc., have been formed at which lectures and demonstrations have been given explaining the repair of fuses and flexes. A demonstration board, wired to show the company's service and the consumer's installation in diagrammatical form is used as a basis of these lectures. More recently a series of fortnightly lectures have been given to a group of fifty W.A.A.F. personnel. The company is designing an electric kitchen suitable for the class of property in the area.

## Flameproof Apparatus

The customary quarterly list of electrical apparatus, mining and industrial, for which certificates of flameproof enclosure have been granted by the Ministry of Fuel and Power (Coal Division) during the three months ended September last, has been issued. At the request of B.E.A.M.A. a few copies are available for purchase at 1s. 2½d. each, post free, from the Library, Ministry of Fuel and Power, King's Buildings, Dean Stanley Street, S.W.1.

## Chile to Make Lamps

The Fabrica Chilena de Ampolletas S.A. has been formed in Chile with a capital of 6,000,000 paper pesos (about $193,550) to manufacture, distribute and sell incandescent light bulbs and other electric lighting apparatus. This marks the establishment of a new combination between Cristalerias de Chile S.A. and the Philips' Gloeilampenfabrieken of Curaçao (N.W.I.). Through the new organisation it is proposed to produce lamps under both the Philips trade mark and the trade mark of Cristalerias de Chile "Cristalux." The existing lamp factory of Cristalerias de Chile is to be utilised by the corporation.—*Reuter.*

## An Inquiry from Cyprus

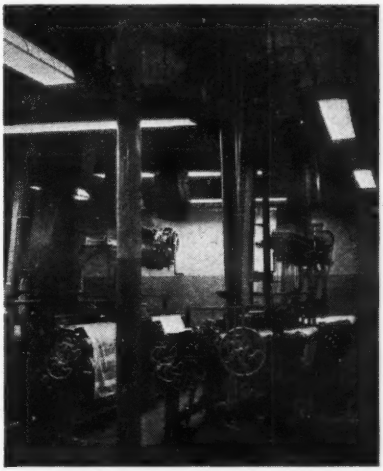
A firm of importers and distributors in Nicosia, Cyprus, wishes to be put in touch with manufacturers who desire to extend their business connections to Cyprus for the following products :—Radio apparatus and parts, general electrical household appliances, refrigerators, electro-medical apparatus, etc. We shall be pleased to forward communications from any manufacturers interested.

## Solid Fuel

No. 10 of the Post-War Building Studies issued by the Ministry of Works (48 pp., Stationery Office, 9d. net), which deals with solid-fuel installations for single-family dwellings, has been prepared by a committee convened by the British Coal Utilisation Research Association. The long-term objective is stated as the introduction of a base-load unit which would supply the essential space-heating, cooking and water-heating requirements. The main recommendations, however, concern standards of performance and design that can be incorporated in the immediate post-war period. The consumption of coal for domestic purposes before the war is estimated at 45 million tons as raw coal, 6 million tons as coke and 12 million tons as electricity and gas. The recommended minimum thermal efficiency of open fires is 35 per cent. compared with a normal pre-war 25 per cent. Smoke emission should be reduced to 1 per cent. of the fuel burned. Fuel consumption for all-night burning (10 hours without refilling) should not exceed ¼ lb. per hr. with bituminous fuel.

## Cotton Mill Lighting

Of all exhibitions with which the E.L.M.A. Lighting Service Bureau has been concerned, there can hardly have been one which so successfully tells its story at first sight as the exhibition



**Fluorescent lighting of Jacquard looms**

of lighting and colour for cotton mills arranged by the Recruitment and Training Department of the Cotton Board in Manchester. The choice of attractive colours for painting machinery is comparatively new in this country, but no one after seeing the examples in this exhibition could deny its value as a means of promoting cheerful working conditions and making the most of well-planned lighting.

Perhaps the most outstanding example of what a calculated combination of light and paint can do is provided by a roving frame and a ring frame which have been treated respectively in blue-green, blue-grey, Devon red and bottle green, and sandy yellow, crimson and signal red. All the colours with the exception of the last (used on control apparatus) are in soft pastel tones. The walls surrounding these machines are in ivory with a dado in pale bottle green. The lighting installation, suspended from the white ceiling, consists of some open and some closed-top fittings each containing an 80-W, 5-ft. fluorescent lamp. Daylight can also be admitted in this instance to demonstrate the

excellent effect achieved by supplementing daylight with fluorescent light.

How the inconvenience of the overhead harness of Jacquard looms can be overcome is shown by a system of single fluorescent lamp fittings installed lengthwise with the looms and the winding frames and two-tube fittings crossways between the looms. Each thread and eye are clearly visible, 40 ft.-candles being achieved on the breast beam and 20 ft.-candles on the beam at the back without shadows. The principles of modern lighting are also demonstrated by a series of cabinet displays.

## Problems of Export

With interest in post-war expansion of exports from this country so much to the fore, the publication by the Institute of Export, Royal Empire Society Building, Northumberland Avenue, London, W.C.2, of a 112-page booklet entitled "Talks About Export" (price 2s. 6d.) is particularly opportune. Marketing abroad presents problems entirely different from those encountered in this country. Shipping practice, finance and insurance are among the most complicated matters needing attention and these are the subjects dealt with in this booklet which contains the substance of twelve lectures organised by the Institute last spring.

## Essay Competition

Owing to the successful results of the essay competitions inaugurated by the Birmingham (Midland) Centre of the Illuminating Engineering Society in 1942 and 1943, a third competition is now being held in which candidates between the ages of 15 and 18 are invited to submit essays on "Street Lighting in Relation to Public Safety." Entries must reach the hon. secretary of the Centre, 125, Moor Street, Birmingham, by December 5th.

## New A.S.E.E. Headquarters

The Association of Supervising Electrical Engineers has transferred its headquarters to larger premises which it has purchased at 54, Station Road, New Barnet (telephone : Barnet 6731/2). Its offices at Aldwych House, W.C.2, were damaged by enemy action.

## Commercial Travellers

The annual court of governors will be held at the London offices of the Commercial Travellers' Benevolent Institution, 4b, Frederick's Place, E.C.2, on December 29th, 1944, at noon.

## Transfer of Retail Business

At a meeting of Burnley Town Council on October 26th advocates of private enterprise succeeded by one vote in referring back a decision of the Electricity Committee to object, under the Location of Businesses Order, to a private electrical and radio firm transferring their business to premises near the Corporation electricity showrooms.

Councillor J. H. Bracewell considered that the Department would benefit by the interest stimulated in electrical apparatus if the shop were allowed to open, and Councillor W. E. Smith said that if the Electricity Department had not confidence in its own ability to push the showroom business it was time they had an inquiry into it. Alderman Buchanan, chairman of the Electricity Committee, said that the Department was handicapped in not getting adequate supplies and it was not considered fair for a business of the same kind to be opened next door. With two shops of the same sort together there would be confusion, and it might be that the showrooms would suffer. Burnley had 469 empty shops if the applicant wanted to select one.

## Transport Valuation Appeals

In February last the London County Council decided to appeal to the Railway and Canal Commission against decisions of the Railway Assessment Authority to insert in the third valuation roll (which operates for five years from April, 1941) the amounts of £1,339,806 and £1,631,068 as the cumulo net annual values of the Southern and Great Western Railways, respectively. It was subsequently decided to appeal similarly against the figure of £1,747,573 in respect of the L.M.S. Railway and at its meeting last week the County Council approved a recommendation of its Finance Committee to appeal against the L.N.E.R. figure of £1,281,553 and that of the London Passenger Transport Board (second valuation roll) of £850,000.

## Cookery Classes for Young People

Early this year the Salisbury Electric Light & Supply Co., Ltd., ran a course of practical classes for men, and the members of this class attained a standard of proficiency in the art of cooking which enabled them to carry off the prize in a contest with a team of A.T.S. girls. Now the undertaking has arranged a course for members of the local youth organisation, a mixed class of eight couples, ranging in age from 14 to 17. The idea actually originated from the members of the youth organisation itself, and the Salisbury undertaking was quick to respond, knowing that these young people will make first-class missionaries of the electrical idea.

# TRADE MARK APPLICATIONS

THE following applications have been received for trade marks. Objections may be entered within a month from October 25th:—

TRISKA. No. 630,080, Class 7. Drilling and grinding machines.—Grimston Electric Tools, Ltd., Progress Way, Purley Way, Croydon.

MAGNODIC. No. 629,728, Class 9. Electrical apparatus and instruments not included in other classes, etc.—High Duty Alloys, Ltd., 89 Buckingham Avenue, Trading Estate, Slough.

BEACON. No. 627,167, Class 11. Electric light fittings, etc., not including electric lamps.—Smith & Davis, Ltd., Beacon Works, Hospital Street, Birmingham, 19.

CANNON. No. 627,702, Class 11. Electric, etc., installations and apparatus for lighting, heating, steam generating, cooking, cooling, evaporating, refrigerating, drying, and water supply purposes, etc. ; and parts (not included in other classes) of all these goods.—Cannon Iron Foundries, Ltd., Deepfields, near Bilston, Staffs.

# Economics of Water Power

## Development for Chemical and Metallurgical Production

HOW hydro-electric power developed in Great Britain can influence the chemical and allied industries is indicated in the fifth Hinchley Memorial Lecture delivered by SIR ALEXANDER GIBB in London to the Institution of Chemical Engineers.

It was in his 1928 presidential address to the same Institution that Sir Alexander spoke of the economics of power as applied to chemical engineering, but the total capacity of water power plant in Great Britain constructed for the sole purpose of supplying energy to electro-metallurgical industries has not yet exceeded the 108,000 kW, or the 145,000 electrical HP then mentioned. Additional power that has become available from water sources in recent years has, however, raised the total capacity of existing installations in Scotland to over 310,000 kW. About one-third of it is utilised for electro-metallurgical purposes and the remainder for public supply.

Several factors which affect the development of water power have changed since 1928. First, the growing realisation of the need to conserve coal resources. In order to avoid the loss of energy necessarily associated with the conversion of intermittent into continuous sources of power, the possibility of basing chemical or metallurgical processes on unregulated tidal power should not be overlooked.

### Fresh Survey of Resources Needed

Recent investigations have shown previous estimates of inland water resources to be too low, and Sir Alexander thinks that the time has come for a fresh review by a new committee of the great changes that have taken place during the past two decades. Available figures indicate the potential hydro-electric power of Great Britain to be not less than 9,541 million kWh per annum, or nearly 40 per cent. of all power generated by authorised undertakers in 1938, representing an annual saving of some 6·4 million tons of coal based on the pre-war average consumption of 1·5 lb. of coal per kWh produced; actually the figure is now approaching 1 lb. per kWh.

It must not be assumed that any such conservation of coal will necessarily release further supplies of raw material for the chemical industry, because a post-war increment of the order of 2,400 million kWh per annum is anticipated in the general demand for electricity. Even if hydro-electric development, both tidal and inland, were to proceed with all speed it could hardly be expected that the output of those sources could be made available at a rate greater than about one-quarter of that required to satisfy the country's increased needs.

The question whether coal burned in electric power stations is suitable for use as a raw material by the chemical industry does not arise, for the saving that would result from the utilisation of water power would be "swallowed up three times over" without directly contributing to the raw material requirements of industry. Increased production of coal is an obvious solution of that problem, but it may be neither possible nor wise.

Secondly, the cost factor has also changed and Sir Alexander expects that coal prices will go on increasing. Already 69 per cent. of the coal produced in Great Britain is machine mined; methods employed in the United States are not necessarily suitable for British coalfields. The increasing price of coal will more than offset expenditure on civil engineering work, which accounts for the difference between the capital costs of water and steam stations of equivalent size.

### Capital Costs and Rating

Even if the rising cost of coal and greater first cost of construction do balance each other to some degree, the basic rate of interest on borrowed capital has fallen to the important extent of placing hydro-electric development in a much more favourable light. In addition, steps are now being taken to adjust the valuation and rating of hydro-electric installations to a basis comparable with that of thermal power stations; hitherto the former have paid something like twice the rates levied on the latter.

A third factor is national security. How the possession of raw materials and the power with which to process them has affected the outcome of the present war must surely teach this country to develop her water power to the full as a measure of self-defence, to enable her to react the more quickly to any temporary loss from outside sources of supplies of vital materials, such as those produced by the chemical industry.

Having thus established what he describes as the paramount national importance of water power, Sir Alexander proceeds to point out that one cannot afford to transmit power electrically over long distances without first seriously considering whether it cannot be equally well utilised at or near the places of generation. In that connection, apart from mentioning new industries which might be established, Sir Alexander considers that Scotland as a whole offers attractions to electro-chemical and electro-metallurgical industries; from those major consumers of

electricity there will follow many chemical industries that are associated with such products as calcium carbide, which are perhaps more appropriately conducted in existing industrial areas. It is understood that tariffs may be offered within the area of the North of Scotland Hydro-electric Board providing energy in large blocks at a high load factor for about ¼d. per kWh.

Hydro-electric development as at present envisaged cannot directly influence industry in England and Wales. At the moment it is doubtful whether any Dee, Mersey or Humber tidal schemes can be justified on economic grounds. But the Severn estuary is an area where chemical and allied industries should find the advantages they are seeking. There alone south of the Border can water power really assist in releasing coal and offer prospects of the establishment on sound economic lines of diverse industries utilising indigenous raw materials.

Hydro-electric power cannot be produced in the British Isles to compare favourably with Canada, the United States and Norway. Therefore industries whose power requirements represent a large proportion of their total production cost are ruled out. The manufacture of silicon carbide is in that category, for electricity (at ¼d. per kWh) represents about 60 per cent. of the pre-war selling price of the American product.

**Possibly Competitive Production**

But there are other "cheap power" industries in which the price of electricity, although greater than abroad, would not affect production to the extent of precluding their competing successfully in home markets, and possibly even in the world market as well, if economies can be effected by higher technical efficiency. Within this group (again at ¼d. per kWh) cost of power represents 28 per cent. of the selling price of aluminium, 26 per cent. in the case of fused alumina, 30 to 40 per cent. for various ferro-alloys, 15 per cent. for calcium carbide, and 2 per cent. in the electrolytic reduction of magnesium, the percentage being greater for the electro-thermal reduction of the last named.

If, for similar purposes, power from the grid is going to cost ¼d. per kWh, as may well be the case, those percentages will be increased threefold, thus making the production at competitive prices of all but one of those raw materials impossible in this country.

Calcium carbide has become a raw material of industrial importance, more especially to chemical industry. The present output in this country is likely to be required for generating acetylene gas for welding and metal-cutting alone. But that gas is the starting point in the synthesis of a large number of organic substances which are not only vital to the chemical industry itself, but also to allied branches dependent upon it, such as the plastics industry. The necessary coke and lime are available in abundance in Great Britain and Sir Alexander feels that carbide production in Scotland and South Wales is not merely desirable, but inevitable.

Economics and national security are closely interwoven in these matters. Which industries are to be encouraged and where they are to be sited must be decided by those controlling the country's destiny.

## Television Prospects

SPEAKING at a meeting of the Scottish Centre of the Institution of Electrical Engineers at the Heriot-Watt College, Edinburgh, last week, MR. B. J. EDWARDS, chief engineer, Pye Ltd., said he thought that within a few years after the war there would be at least two television transmitters working in Scotland. Subject to certain economic factors after the war, television receivers could be marketed for about £30. In ten years after the war, television should be as popular as radio was now.

Large-scale television in colour and "three-dimensional" films are points in a ten-year technical development plan for the British film industry outlined by MR. A. G. D. WEST in his presidential address to the British Kinematograph Society. The programme allows two years for the re-design of commercial equipment and re-equipping of film studios and cinemas with modern equipment; two years for the full development of the colour film and standardisation of screen brightness; by the end of two more years, the practical realisation of commercial high-definition large-screen television, together with the means of providing and distributing television programmes of special events; a further two years for the provision of large screen television in colour; and the final two years for a practical solution of stereoscopic projection.

## Safety in Mines

THE twenty-second Annual Report of the Safety in Mines Research Board (Stationery Office, 1s.), relating to 1943, contains a short electrical section. In this it is stated that the success that has attended the safeguarding of approved electrical apparatus is reflected in the low accident rate during many years. Some new types, however, may need more than routine testing, *e.g.* signalling and shot-firing devices and remote-control devices for power circuits, in view of later test developments. Some preliminary results of investigations between various factors which control intrinsic safety are given; these are expected to contribute to a scientific treatment of the design of low-power circuits equal to that of flame-proof enclosures.

The strengths of flame-proof enclosures have been tested from the laboratory scale to the full scale by submitting them to the pressure produced by firing a charge of gun-cotton within them, a much simpler method than gas explosion. Measurements of the gripping power of various cable glands have been completed, and recommendations have been made which should lead to stronger connections.

# ELECTRICITY SUPPLY

## North Wales Water Power. Conditions in Christchurch.

**Bradford.**—WASTE HEAT UTILISATION.—On the question of utilising the waste heat from the Valley Road power station for district heating, the city electrical engineer has reported to the Reconstruction Committee that, having regard to the location of the station in relation to the area that could be served, the station does not lend itself to the successful application of this form of heating.

**Conway.**—DEVELOPMENT PLAN SUPPORTED.—The Borough Council has decided to give wholehearted support to the plan for the development of electricity in Wales as set out in a pamphlet recently issued by the Welsh Nationalist Party entitled "Plan Electricity for Wales." The town clerk is to write to the Association of Welsh Local Authorities and to the North Wales and South Cheshire Local Authority Electrical Undertakers' Association asking them to pass similar resolutions.

**Coulsdon.**—MATERIAL FOR STREET LAMPS.—The Urban District Council, which sought permission to acquire cast-iron for street lighting equipment, has been informed by the Ministry of Health that in view of the stringent necessity for conserving materials for essential war purposes, it is only prepared at the present time to authorise the release of materials for repair and maintenance of public lighting equipment where starlighting is in operation.

**Exeter.**—ELECTRICAL APPLIANCE MAINTENANCE COSTS.—The city electrical engineer has reported that the wear and tear of electric cookers and water heaters installed in business premises where public catering is undertaken is much greater than on those used for private domestic purposes and consequently the cost of maintenance is exceptionally heavy. The Electricity Committee has agreed that, in view of the increased cost of materials and labour, notice shall be given that free maintenance can no longer be provided in such cases, and that half the cost will be charged in the future.

In view of the fact that the cost of materials for maintenance purposes have increased by 50 per cent. over pre-war prices and wages are up by approximately 40 per cent., it has also been decided to withdraw the existing rebates on the standard rentals for electric cookers and water heaters.

**London.**—STREET LIGHTING REPAIRS.—Westminster City Council has approved an estimate of £17,557 for street lighting renewals, of which £15,195 will be claimed as war damage.

**Middlesbrough.**—ALLOCATION OF SURPLUS.—The Electricity Committee has considered the annual report of the electrical engineer for the twelve months ended March 31st last and has decided to transfer £2,500 to the reserve fund and carry forward £10,583.

**Northern Ireland.**—BOARD'S SCHEME OPPOSED.—At a special meeting of the Antrim Town Commissioners on October 27th, a resolution was adopted objecting to the Electricity Board's proposed development scheme in so far as it affected the town. The Commissioners contended that the Antrim Light and Power Co. had fully electrically developed the town and had at all times given satisfactory service for public and private purposes.

**North Wales.**—WATER POWER DEVELOPMENT PLAN.—A proposed hydro-electric scheme for North Wales was outlined by Mr. J. Rankin, general manager of the North Wales Power Co., at a meeting of the North Wales and South Cheshire Joint Electricity Authority last Friday. After a survey by Mr. R. Freeman, designer of the Sydney Harbour bridge, and Mr. J. Williamson, who is associated with the Scottish Highlands hydro-electric scheme, they had, said Mr. Rankin, made recommendations for substantially increasing the output of electricity in North Wales. These were being examined by a technical committee of the company. The report showed, he added, that hydro-generation could become one of the biggest industries in North Wales.

Mr. C. F. White said the present anomalous system of valuation of hydro-electric power stations in North Wales was a serious handicap to development. The principles of rating relief put forward for hydro-electric undertakings in Scotland should apply to similar undertakings in Wales. On this point Mr. Rankin remarked that it was impossible to expect any hydro-electric undertaking to develop under the present fantastic system of rating, which gave no relief such as applied to an ordinary industrial concern. The scheme he had outlined could not be carried out unless there was an abatement of the extraordinary burden of rates which was at present carried.

The meeting decided to support the recommendations in the Scottish report on rating relief, and to urge the Government to grant a subsidy for the electrification of rural areas.

**Salford.**—NEW POWER STATION.—The Light, Heat and Power Committee recommends the appointment of L. G. Mouchel & Partners, Ltd., as consultants in connection with the proposed new power station at Agecroft.

### Overseas

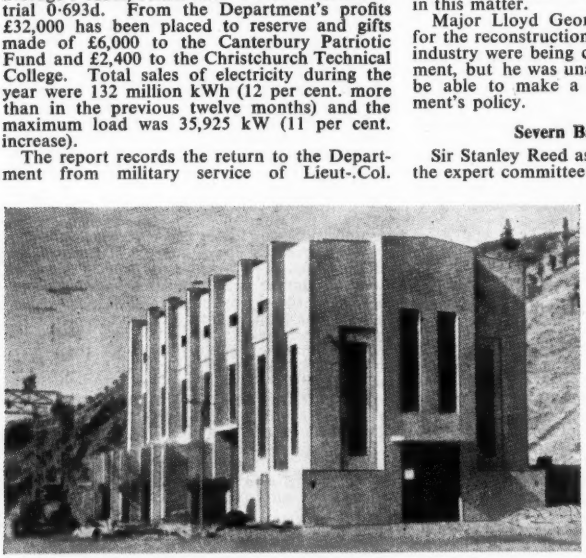
**New Zealand.**—CHRISTCHURCH REPORT.—An interesting commentary on wartime conditions is given by Mr. E. Hitchcock, general manager of the Christchurch Municipal Electricity Department, in his report for the year ended March 31st last. Reference is made to the growth in the number and capacity of welders and of imported machines with built-in motor drives. This has raised the question of the control of motor starting currents, and of the power factor, balancing and fluctuation of welder loads, and uniform action by supply authorities is called for.

With regard to operating conditions, the only major trouble was a heavy snowstorm which interrupted transmission between the Government's Waitaki and Lake Coleridge power houses and necessitated a reduction of the load in the city for the greater part of two days. The report includes a photograph of the Government's new Highbank power station on the south bank of the Rakaia River which is scheduled to be in operation this year. This development combines irrigation and power

supply. A 42-mile race brings about a " meeting of the waters " of the Rangitata, Ashburton and Rakaia Rivers. The head is 330 ft. and the capacity of the plant 28,000 kVA.

The financial results of the year's working were again abnormal. Revenue rose by £41,942 and the cost of electricity purchased by £18,000, apart from which working expenses were practically stationary. The average price paid by consumers was 0·725d., the lowest yet recorded. Domestic consumers paid on an average 0·622d., commercial 1·545d. and industrial 0·693d. From the Department's profits £32,000 has been placed to reserve and gifts made of £6,000 to the Canterbury Patriotic Fund and £2,400 to the Christchurch Technical College. Total sales of electricity during the year were 132 million kWh (12 per cent. more than in the previous twelve months) and the maximum load was 35,925 kW (11 per cent. increase).

The report records the return to the Department from military service of Lieut-.Col. J. C. Forsyth, chief electrical engineer, Lieut.-Col. C. L. Walter, D.S.O., distribution engineer (who has seen active service in Greece, Egypt, Syria and from El Alamein to Tunisia and Italy), and Capt. S. J. Geary, mains superintendent. The death is recorded with regret of Mr. Eric Bent, meter testing assistant, who was killed as a result of an accident while on active service in Italy.



**The New Zealand Government's new Highbank power station**

# TRANSPORT

**Bradford.**—LOAN FOR TROLLEY-BUSES.—The Transport Committee recommends the purchase of 12 trolley-bus bodies at a cost of £1,200 each and is seeking sanction to borrow £75,000 for the purchase of 25 double-deck trolley-buses.

**Stockport.**—MINISTRY REJECTS PLAN TO CHANGE TO BUSES.—The Ministry of War Transport has refused the Corporation's application for permission to substitute motor-buses for trams on the Stockport-Manchester route, where the tram track is in a bad condition. Manchester Corporation offered to provide the buses.

# Parliamentary

**By our Special Reporter**

### Electricity Reorganisation

IN the House of Commons on October 24th Mr. J. Griffiths asked the Minister of Fuel and Power what steps he was taking to secure the reorganisation of the generation and distribution of electricity; and when he would be able to make a statement of the Government's policy in this matter.

Major Lloyd George replied that proposals for the reconstruction of the electricity supply industry were being considered by the Government, but he was unable to say when he would be able to make a statement on the Government's policy.

### Severn Barrage Scheme

Sir Stanley Reed asked whether the report of the expert committee appointed to examine the project for a barrage and hydro-electric installation on the River Severn had yet been received; if it would be published; and whether the scheme would be treated as one of urgency.

Major Lloyd George said he had now received the report and was arranging for it to be published as soon as possible. Meanwhile it was being very carefully studied, but as the proposals raised some very serious issues he could give no indication when he would be able to announce a Government decision on the project.

Later, Mr. Tom Smith, the Under Secretary, informed Sir Charles Edwards that in its report the Committee recommended that proposals for a road and rail bridge should be considered independently.

### Soil Warming

Mr. E. P. Smith asked the Minister of Agriculture whether his attention had been called to the farming experiments being conducted by the Soviet authorities in the Arctic under which extensive fields of cabbage, potatoes and other plants were successfully grown under Arctic conditions in electrically warmed soil, and what progress was being made in this country with regard to research and development in connection with the warming of soil by artificial means of this kind.

Mr. R. S. Hudson said that no official information was available with regard to the experiments referred to in the first part of the question. Work on soil heating by various means, including electricity, had been carried out in this country for some years, mainly in connection with crops grown under glass. Particulars of the various methods of soil warming available would be found in Bulletin No. 65 issued by the Ministry of Agriculture.

# Organising Installation Work

## Tenders, Specifications and Contracts

By T. Dunwoody, Associate I.E.E.

IN view of the amount of work which will have to be done very quickly immediately after the war, it seems opportune to examine the question of organisation to meet the demands that will be put upon electrical installation engineers and endeavour to ensure an efficiently working machine, even if it is not known precisely what the machine is going to do.

In pre-war days, apart from business obtained through private connections, the contractor found that work could only be obtained by competition. He was either invited to tender or applied for work which was open to general competition. An invitation received by a contractor would indicate that possibly five or six other firms of repute and standing would be involved. With a public tender twenty or thirty firms might be competing and the field was open to all who could afford to risk the usual deposit.

There was a tendency for established firms to rely upon their private connections and the limited competition type of tender—usually emanating from a consultant, or architect who wholly relied upon certain contractors for technical advice. The less established and aspiring firms were more concerned with the "open" tenders, usually for works initiated by public authorities, whilst striving to create a goodwill which would bring in the more profitable type of contract. There was not, however, a rigid line of demarcation. When contracts which would give prestige to the successful contractor went out to open tender, both types of firms would compete; and also in times of depression "private" work was more quickly affected than "public" work, thus again causing the well-established contractor to invade the "open" market.

***Suggestions are made in this article for regularising the electrical contracting business to remove a great deal of the unnecessary doubt and disorder which often exist under the present arrangements***

In spite of this, however, the influence of the normal sphere of business in which the firms participated was shown in their organisation. On the one hand was the contractor with a well-furnished office suite and a staff of experienced engineers who were in a position to make a good job of their work, knowing that normally there would be a fairly comfortable margin of profit and that variations to the work, upon which financial adjustments could be made, were inevitable.

On the other hand was the contractor whose work was secured in the teeth of keen competition and whose profit margin was very low. His prime motive had to be to get the job done as cheaply as possible—to keep his overheads low, to save money on materials and labour—and not necessarily to produce a better job than the specification stipulated. Being human, he was also very glad if a loophole in the specification gave him the opportunity of incurring some unexpected advantage.

There was merit to be found in both methods of organisation, but the tendency was to produce cycles of extreme activity and dormancy, depending on the results of tenders. This caused instability in the labour market and had repercussions elsewhere. A new and very important factor has arisen due to emergency conditions. In the past, price was in the main the governing factor which decided the fate of a tender; to maintain the productive effort it has now become necessary to consider the firm's *capacity* for the work involved. This has reduced the keenness of competition and, it may well be, has increased the cost of the work, but in my opinion it has been of mutual benefit to all concerned. The restraint of competition to reasonable proportions, and its confinement to firms who can give the required attention to the work, is an admirable policy, and encourages the participation of the two types of contractor mentioned in the whole sphere of electrical installation to which they are suited. It is, however, equally important to establish a basis of tendering which eliminates unnecessary risk to the competing contractor.

It has always seemed unethical that many tenderers were successful only because they had left something out of their tender which should have been included, either due to ambiguity of the specification or their own carelessness in estimating. No one can question the desirability of eliminating such risks from tenders, and no client would demur at the removal of the possibility of having something given to him for nothing due to a contractor's error.

In my experience the most satisfactory method of obtaining estimates is to use a comprehensive schedule to be priced by the contractor. In the case of public authorities, it is safe to assume that sufficient staff exists for the compilation of such a schedule, but in other cases the consultant would have to prepare the schedule and take the onus for its accuracy. This in its turn means additional duties for which added remuneration should be received. The schedule should clearly cover all contingencies and be so devised

that all variations from it can readily be valued.

The best plan is to reduce the schedule to easily assessable units—switchgear should be measured separately, lighting points, switch outlets, etc., clearly defined. It is not necessary to refer to prime cost items or provisional sums in the schedule, as the contractor needs no knowledge of such allocations. Should items that have to be dealt with on a prime cost basis be anticipated, the contractor should be asked to quote a percentage profit varying with hypothetical amounts expended.

The subject of a standard schedule deserves an article to itself and certainly should receive the attention of such bodies as the I.E.E. and E.C.A. in conjunction with the Surveyors' Institute. There can be no excuse for the contractor who makes errors in pricing such a schedule, and as a large measure of risk is removed, it is anticipated that the contractor would welcome this method of tendering. It would also save a tremendous amount of time and research both when estimating and when materials have to be ordered.

A suggestion has been put forward that the present lump sum price method of tendering without individually priced items for comparison should be continued, but with a schedule priced by the contractor for "extras" only. This method does not remove the evil prevalent in certain circumstances where the tender is cut to the bone with the intention of recouping possible losses on the "extras."

### The Specification

Complementary to the schedule are, of course, the specification and drawings. The specification should be clear and concise. There should be no possibility of misinterpretation of the clauses; and the practice of concealing in obscure phraseology the intentions of the compiler, savours of lack of conception of true business principles. It should always be appreciated that the specification has to be read by the man who is doing the job and it should be written with that end in view. There should be three sections to the specification. The first should be a summary of the contract details with other general clauses. The second should be a comprehensive description of the materials to be used—there should be no doubt about the intentions of the engineer responsible for the specification in this respect. The third and last section should unfold the actual work to be carried out, describing definitely all the "labours" involved, and elaborating the price schedule.

The name "contractor" would imply that the contract was the main concern of the individual so designated. This is far from being the case and it is to be doubted whether, until the unpleasant significance of the document is forced upon him, the average contractor gives much attention to anything but the interim payment, maintenance, and percentages on daywork clauses. In point of fact the prevalent form of contract reacts unfairly upon the specialist contractor. It is the accepted practice, apart from the comparatively rare circumstances in which no other trades are employed at the same time, to subordinate the specialist to the role of sub-contractor to a builder. This enables the client to transfer to the builder all legal responsibility to the specialist for payments, etc., even although the specialist is nominated and the builder has no say in his selection. Payments for work executed by the sub-contractor are, therefore, made by the client to the main contractor and if the main contractor defaults the sub-contractor receives only part payment or no payment at all.

### Sub-Contracts

Under this system of contract, the main contractor receives a percentage for handling the sub-contracts from the client, and is supposed to organise and co-ordinate the sub-contractors, pass on instructions, lend plant, etc. This never happens in practice. In most cases the builder is too intent on his own pursuits to manage sub-contracts efficiently; and it is undesirable that he should manage specialist operations, especially that of electrical installation.

The organisation of electrical installation contracts and co-ordination with others should be the joint responsibility of the electrical contractor and the consultant, and through the consultant to the architect. It is only by this type of organisation that one will obtain an intelligible programme of works and ensure the satisfactory installation of the scheme. The contract should be a direct engagement with the client and should be suitably framed for electrical installation work. There is no basic contract analogous to the R.I.B.A. document in general use; the I.E.E. "Model General Conditions" do not cover all possible contingencies.

It is suggested that the Institution of Electrical Engineers might usefully devote some time to this, in conjunction with the preparation of a suitable schedule. There would be far less friction and misunderstanding amongst the various parties if this method of separate contracts were adopted. Not the least of the advantages would be the removal of the tendency by the client or his representatives to place the blame on the builder for all complications arising with the sub-contract whether the builder has any control over them or not.

It becomes apparent in considering the problems that arise that the prospective client must have an experienced consulting engineer as a technical adviser. It is to be

regretted that so much work is handled by architects without the expert supervision that is essential. Something should be done to impress upon the client that it is in his own interests to ensure that he receives advice from a source competent to give it, especially as any extra expense involved would be more than recovered in the provision of an efficient and economical job. It is not proposed, however, to elaborate upon this important aspect of electrical installation work at the moment. In a second article questions that affect drawings, site organisation and labour problems will be discussed.

# Latin-American Trade

## Prospects for British and American Exporters

ON the subject of the future possibilities of the electrical trade of Latin America, in particular Argentina and Brazil, some important pronouncements have just been made. One, reproduced by the Bank of London and South America in its fortnightly review, is by an official of the Westinghouse Electric International Company of the United States. He returned recently from a visit to Central and South America and reported that a steady extension could be expected in the near future in the export to Latin America (Brazil especially) of electrical goods, notably heavy generating equipment and parts for railways and industrial machinery. He declared that larger shipments of electrical material were necessary for essential industries and hydro-electric projects which were being developed in Latin-American countries. The potential market there for domestic appliances such as refrigerators, fans, washing machines, stoves and irons, was very great.

The Westinghouse spokesman mentioned a point of great interest to the British electrical manufacturing industry, namely that it was not possible to say when United States manufacturers would be allowed to produce these articles in sufficient quantities for export, but some makers expected that by the beginning of 1945 certain articles might be produced in sufficient volume for this purpose. He added that although after the war the more industrialised Latin-American countries, particularly Brazil, were expected to be in a position to produce some of their own electrical material, United States concerns would still be able to count on a considerable share in those markets for electric heating apparatus and parts.

### Argentine Import Tariff

Another contribution on the subject of prospective Latin-American import trade is official in character and contained in *Foreign Commerce Weekly*, published by the U.S. Department of Commerce, Washington. It traces the gradual building up of the Argentine import tariff and its influence on the growth of the factory industries of that country. There is now a permanent tariff commission which is revising Customs valuations periodically and advising on questions of increasing or reducing rates of duty. A sub-committee of this commission has issued a report covering the section of the tariff which includes machines, apparatus and electrical material, with the proposed nomenclature and tariff items, but no data as to the proposed new valuations of rates of duty and surtax which are to apply. Meanwhile interested institutions, industrialists and merchants are invited to submit their comments and suggestions to the Comision Para el Estudio de la Tarifa de Avaluos, Ministerio de Hacienda, Buenos Aires.

### Electrical Manufacture in Brazil

According to the same authority notable progress has been made in the manufacture of electrical equipment in Brazil. Plans are under way to erect a large plant in the Sao Paulo area immediately after the war. An increase is then expected in the output of lamps, wire and cable, fuses, switches, transformers, irons, welding equipment, some types of electric motors, lighting fixtures, radio parts, conduits, vacuum cleaners, heaters, equipment for aircraft and automobiles, and dry batteries.

In connection with the manufacture of electrical material generally the Brazilian Government has appointed a special committee with power to take steps to establish a large-scale electrical material industry in the country. For this purpose the committee is to make any arrangements necessary (including arrangements abroad); undertake the required technical and economic studies, and subsequently fix the locality and size of the projected installations; study the adoption of measures for the development of the raw materials which are to be utilised; and organise a national concern with Government and private capital to establish and operate the industry. The committee will consist of ten members nominated by the President of Brazil. In recording this official move the Bank of London and South America says that among the new industrial plants to be installed in the Sao Paulo district is one by a well-known concern to manufacture a very large range of electrical goods, including transformers and other heavy equipment, refrigerators and radio sets. This concern already has a plant in Rio de Janeiro producing lamps and other articles.

# FINANCIAL SECTION

## Company News. Stock Exchange Activities.

## Reports and Dividends

**Crabtree Electrical Industries, Ltd.,** is paying a final dividend of 5 per cent. and a cash bonus of 7½ per cent., again making a total distribution of 17½ per cent. for the year. The trading profit of the operating company, J. A. Crabtree & Co., Ltd., for the year ended July 31st last amounted to £244,292 as compared with £244,272 in the previous year. The net profit was £72,439 (£53,305).

**Erinoid, Ltd.,** records a trading profit of £87,640 for the year ended July 31st last as compared with £121,334 in the previous year. Adding other receipts the total available is £90,505 (£122,940). After providing for directors' fees £1,897 (£1,933), depreciation £10,260 (£9,727) and taxation £61,546 (£95,306), the net balance is £16,802 (£15,974). The ordinary dividend is maintained at 10 per cent. and £10,350 (£8,948) is carried forward.

**Cables Investment Trust, Ltd.**—At the general meeting on October 25th, Sir Edward Wilshaw, who presided in the absence through indisposition of Lord Pender, the chairman, said that the improvement in the value of the company's investments had been maintained and for the first time since June 30th, 1937, the market value of the investments exceed the book cost. In the intervening years values had been unduly depressed by war and fear of war.

**The Atlas Electric & General Trust, Ltd.,** reports a net revenue for the year ended March 31st last of £121,150 (against £115,983). The 7 per cent. preference dividend is paid and £168,189 (£159,695) is carried forward. The last dividend on the ordinary shares was 1 per cent. for 1931-32. The gross receipts of the subsidiary, Sociedad Commercial de Montevideo (tramways), increased from $5,763,838 to $6,179,572. The balance of revenue over operating costs fell from $276, 958 to $263,689, the debit balance carried forward being reduced from $1,235,162 to $971,473.

**Peto Scott Electrical Instruments (Holdings), Ltd.**—Speaking at the annual meeting on October 27th the chairman, Mr. M. Campbell Jones, referred to the increase in the dividend from 20 to 25 per cent. He said that the factories were working to capacity and preparations were being made to meet the change-over to peacetime production.

**Oliver Pell Control, Ltd.,** records a net profit of £4,749 for the year ended March 31st last, as against £4,030 for 1942-43. Preference dividends for the eighteen months ended June, 1941, take £2,250, leaving £3,015 (£516) to be carried forward.

**Richard Johnson, Clapham & Morris, Ltd.,** show a profit of £42,163 for the year ended June 30th last (against £32,253). The ordinary dividend for the year is again 15 per cent.

**The Lincolnshire & Central Electric Supply Co., Ltd.,** reports a total revenue for the year ended March 31st last of £81,083, as against £84,247 in the preceding year. The net profit was £53,960 (£55,448). An ordinary dividend of 9 per cent. is again to be paid and general reserve receives £2,500 (same), leaving £36,551 (£31,215) to be carried forward.

**Strand Electric Holdings, Ltd.,** reports that the profit of the Strand Electric & Engineering Co. for 1943-44, available for dividend to the Holdings Company, was £7,827 (against £6,639). The Holdings Company's available balance for distribution, including £1,427 brought forward, is £9,022. The dividend is maintained at 10 per cent. and in addition a bonus of 2½ per cent. is being paid.

**Murex, Ltd.,** had a total income of £443,023 (a decline of £76,745) for the year 1943-44. The gross profit was £439,446, against £516,507 but the allocation for taxation was £123,500 lower at £200,000. The dividend and bonus are maintained at 20 per cent., as already reported.

**The British Electric Traction Co., Ltd.,** is again paying an interim dividend of 15 per cent. on its deferred stock.

**The Electrical Finance & Securities Co., Ltd.,** is maintaining its interim dividend at 4 per cent.

**The Anglo-Portuguese Telephone Co., Ltd.,** is again paying an interim dividend of 3 per cent.

**The Ever Ready Co. (Great Britain), Ltd.,** is maintaining its interim dividend at 15 per cent.

## New Companies

**Baldwin Electrical Co. (Sheffield), Ltd.**—Private company. Registered October 23rd. Capital, £25,000. Objects: To acquire the business of electrical engineers carried on by W. T. Baldwin and H. T. Baldwin at Ellin Street, Sheffield, as the Baldwin Electrical Co., and to carry on the business of electrical, motor, refrigerating, radio and general engineers, etc. Directors: W. T. Baldwin, 33, Clarendon Road, Sheffield, and H. T. Baldwin, Joan Lane, Bamford, near Sheffield. Registered office: Ellin Street, Sheffield.

**London Electronic Developments, Ltd.**—Private company. Registered October 20th. Capital, £3,000. Objects: To carry on the business of radio and electrical engineers and contractors, etc. Directors: J. B. B. Collings, 52, Upper Cheyne Row, S.W.3 ; I. I. Miller (Russian), 19, Caledonian Road, N.1 ; and N. P. T. Holmes, 52, Upper Cheyne Row, S.W.3. Registered office: 12, Park Row, N.W.1.

**Herbert Electrical, Ltd.**—Private company. Registered October 24th. Capital, £800. Objects: To carry on the business of manufacturers of, and dealers in, electrical, refrigerating and air-conditioning plant and accessories, wireless sets and accessories, etc. Directors: A. Herbert, 50, Armour Road, and P. Herbert, 108, Oaktree Road, both Tilehurst, Reading. Registered office: 22, St. Mary's Butts, Reading.

**Progressive Electrical (Barnet), Ltd.**—Private company. Registered October 25th. Capital, £400. Objects: To carry on the business of manufacturers of, and dealers in, electrical plant and supplies, motor vehicles and accessories, etc. Directors: E. G. Deaner, Comrie, Fitzjohns

Corner, Mays Lane, Barnet, and W. Kopkin, 32, Eldon Avenue, Boreham Wood. Registered office: 26, Sebright Road, Barnet.

**Hudson Wolff, Ltd.**—Private company. Registered September 26th. Capital, £2,000. Objects: To carry on the business of electrical, wireless, marine, aeronautical, internal combustion and general engineers, etc. Subscribers: W. S. Wolff, 139, Kings Avenue, Woodford Green, Essex; and Dorothy Morgan, 73, Basinghall Street, E.C.2., Solicitors: Alfred Bieber & Bieber, E.C.2.

**Good Listening, Ltd.**—Private company. Registered October 14th. Capital, £10,000. Objects: To carry on the business of electrical, radio, television, telephone and general engineers, etc. Subscribers: R. B. Stoney, Holmlea, Durrington, Wilts; and Elfrida E. Weaver, 1, Queen's Park Gardens, Bournemouth. Secretary: M. P. Simmons. Registered office: Upper Hinton Chambers, Bournemouth.

**Hertford Refrigeration Co., Ltd.**—Private company. Registered October 14th. Capital, £1,000. Objects: To carry on the business of manufacturers of, and dealers in, refrigerators and cold storage machinery and equipment, etc. C. M. Grant, 76, Great Queen Street, Dartford, is permanent governing director. Registered office: 80, Mackenzie Road, Holloway, N.7.

**J. F. Tomlin, Ltd.**—Private company. Registered October 16th. Capital, £500. Objects: To acquire the business previously carried on by Tomlin & Watford, radio and electrical engineers, of 60, Arthur Road, Windsor. Directors: J. F. Tomlin and Mrs. N. Tomlin, both of 48, High Street, Saltney, Chester. Registered office: 60, Arthur Road, Windsor, Berks.

## Companies Struck off Register

The following companies were struck off the Register on October 27th:—B. & S. Radio (London), Ltd., and Drying Cabinets, Ltd.

# Companies' Returns

## Statements of Capital

**Sphere Electric Instrument Co., Ltd.**—Capital, £1,000 in £1 shares. Return dated May 25th. All shares taken up. £1,000 paid. Mortgages and charges: Nil.

**L. E. Wilson & Co., Ltd.**—Capital, £2,000 in 2,000 ordinary shares of £1 each. Return dated May 11th. 1,602 shares taken up. £1,602 paid. Mortgages and charges: Nil.

**Bristol Heating & Engineering Co., Ltd.**—Capital, £1,000 in £1 shares (all ordinary). Return dated June 10th. 400 shares taken up. £400 paid. Mortgages and charges: Nil.

**D. P. Battery Co., Ltd.** Capital, £100,000 in £1 shares. Return dated June 6th. All shares taken up. £28,000 paid. £72,000 considered as paid. Mortgages and charges: Nil.

**Marlborough Electrical Co., Ltd.**—Capital, £1,000 in £1 shares (all ordinary). Return dated July 3rd. 600 shares taken up. £600 paid. Mortgages and charges: Nil.

**Bective Electrical Co., Ltd.**—Capital, £10,000 in 116 6 per cent. preference and 80 7 per cent. preference shares of £50 each, and 4,000 ordinary shares of 1s. each. Return dated June 30th, 1944. 116 6 per cent. preference, 72 7 per cent. preference and 4,000 ordinary shares taken up. £9,600 paid. Mortgages and charges: £7,500.

**Automatic Coil Winder & Electrical Equipment Co., Ltd.**—Capital, £10,000 in 10,000 ordinary shares of £1 each. Return dated July 5th. All shares taken up. £3,000 paid. £7,000 considered as paid. Mortgages and charges: Nil.

**Power Centre Co., Ltd.**—Capital, £5,000 in £1 shares. Return dated December 22nd (filed July 28th). 3,614 shares taken up. £2,114 paid. £1,500 considered as paid. Mortgages and charges: £1,000.

## Increases of Capital

**Dorland Electric Co., Ltd.**—The nominal capital has been increased by the addition of £900 in £1 ordinary shares beyond the registered capital of £100.

**Insulation Equipments, Ltd.**—The nominal capital has been increased by the addition of £45,000 in £1 ordinary shares beyond the registered capital of £5,000.

## Mortgages and Charges

**Palace Electrical Co., Ltd.**—Charge on proceeds of contract, dated October 2nd, 1944, to secure all moneys due or to become due from the company to Midland Bank, Ltd.

**Hammond Engineering Co., Ltd.**—Satisfaction in full on February 27th, 1942, of mortgage dated March 24th, 1938, and registered April 6th, 1938. (Notice filed October 23rd.)

# Bankruptcies

**W. H. Axworthy,** electrical contractor, John Lane, Cobourg Street, Plymouth, Devonshire, lately carrying on business at New Town Chambers, Old Town Street, Plymouth.—Debtor's application for discharge was heard recently at Plymouth. The receiving order was made in 1938, when the liabilities were returned at £1,213, against assets of £22. The debtor offered to pay a sum of £100 by quarterly instalments of £10 each and the discharge was granted.

**J. A. Whiteman,** lately wireless dealer, 4, Northfields, Kilburn, trading as Northfield Radio.—Order made September 20th for debtor's discharge subject to his consenting to judgment being entered against him for £50. (The Official Receiver has certified that £50 has been paid to him in lieu of entering up judgment.)

**D. F. Wilkinson,** electrical engineer, lately carrying on business at 238, Stockingstone Road, Luton, and formerly at 25, John Street, Luton.—Application for discharge to be heard on November 30th at the Court House, Stuart Street, Luton.

**K. G. Burfield,** electrical contractor, Espere, Couchmore Avenue, Clayhall Avenue, Ilford.—First meeting to-day (Friday) at 42, Tavistock Square, London, W.C.1. Public examination, November 24th, at the Shire Hall, Chelmsford.

**R. Jackson,** electrician, lately carrying on business at 38, Whalley Range, Blackburn. Proofs for dividends by November 14th, to the trustee, Mr. W. G. Pearson, 16, Cornwallis Street, Barrow-in-Furness, Official Receiver.

# STOCKS AND SHARES

TUESDAY EVENING.

THE disposition of Stock Exchange markets has assumed a brighter tone. The news from the war fronts has helped to increase confidence in the stability of markets, and post-war prospects are once more prayed in aid of optimism as to expansion of profits and increased dividends. At the same time, vague talk of a possible lightening of taxation has made itself heard—which seems to be more wishful thinking.

Prices of industrials keep very firm, but the Home Railway market has gone back after its brief spurt. There appears to have been no great volume of public support at the back of the recent improvement. Home electricity supply shares mostly hold their prices. The volume of business in Stock Exchange markets is on a larger scale than it has been of late.

**Fewer Fluctuations**

Price alterations in this week's lists are fewer than usual, and fewer still are of outstanding consequence. Calcutta Trams continue to be the sport of speculation based upon estimates of the likely repayment price when the Calcutta Corporation takes over the system. At 69s. 6d. the price is a florin up. Perak Hydrō-Electrics further hardened, to 13s. 6d., on last week's defeat by the Americans of the Japanese navy. Tokyo Electric sixes were unchanged at 27.

In the Home electricity group, Northmets went back 1s. 6d. to 42s; the price still looks high by comparison with others of similar character in this market. Electricity Supply Corporation ordinary at 49s. and County of London ordinary at 43s. 6d. are respectively 6d. better and easier. Ever Ready hardened to 40s. 9d. following the announcement of the usual interim dividend of 15 per cent. Crabtrees at 40s. 6d. are a trifle down, although the dividend and bonus again make 17½ per cent. for the year. Thorn Electrics at 26s. 3d. are 3d. harder.

**Equipment and Manufacturing**

International Combustions at 6½ are 2s. 6d. better. Murex, at 96s. 3d., have gained ⅛, and Mather & Platt at 55s. have risen 1s. 9d. Revo at 41s. are up 1s., English Electrics 9d., at 51s. 3d. A rise, also of 9d., lifted Vactrics to 17s. 3d., a very tardy recognition of the return of the shares to the dividend list. The yield is still as high as 6½ per cent. on the money. De la Rue ordinary relinquished the ⅛ they gained last week. Enfield Cables are 1s. down at 61s.

Radio shares are quieter, with prices tending to droop. Pye deferred at 32s. 6d. are ⅛ lower and E.M.I. have gone back 6d. to 34s. 6d. E. K. Cole shares retain their previous advance to 33s. 6d. Philco at 13s. show no change: the new shares are a trifle lower.

**Miscellaneous Matters**

The Portuguese Government has given notice of its intention to institute an inquiry into the affairs of the Anglo-Portuguese Telephone Co., similar to that which took place not long ago in connection with Lisbon Tramways. Presumably this is a formal affair, and will not affect the business of the company. The price of the shares has gone back 6d. to 27s. 6d. The report of the Atlas Electric Trust shows a slight improvement on the previous year, and the 2,000 preference shares which were on offer at 26s. 3d., as mentioned here at the time, were duly taken. The ordinary shares are unchanged at 7s. 3d. The report holds out little hope of any change in the position as it relates to the Uruguayan undertaking in which the Atlas Electric Trust has so large a financial stake. Victoria Falls preference shares have been coming to market and the price, 35s. not long ago, has gone back to 28s. 6d. Considerable uncertainty exists as to the precise standing of the preference shares if the Union Government should give notice in 1948 of its intention to expropriate the undertaking in two years' time from then.

**Associated British Engineering**

The price of Brush Electrical Engineering shares remains at 10s. 9d., as it is likely to do until a fairly large line of shares, which at present is offered at that price, has found a home. The shares are being absorbed by degrees, and when the line is completed, there may be an improvement, on the expectation that the dividend, now 9 per cent., will be raised to 10 per cent. in respect of the past year. The Brush Company is controlled by the Associated British Engineering Company which, some years ago, sold to the Brush Company the assets, plant, machinery, goodwill and name of Petters, Ltd. The Brush Company paid partly in allotment of its own preference and ordinary shares. At the present time, the Associated British Engineering has about £363,000 in Brush Electrical stock.

**Dividend Outlook**

For several years, Associated British Engineering paid 5 per cent. on its ordinary shares, raising this to 6 per cent. for the year ended March, 1943, and 7 per cent. in respect of the twelve-month last finished. The anticipation of an improved Brush dividend, mentioned above, leads to the natural assumption that there will be an advance in the Associated British Engineering distribution. This is the reason why the shares of

(*Continued on page* 646)

# ELECTRICAL INVESTMENTS

## Prices, Dividends and Yields

| Company | Dividend Previous | Dividend Last | Middle Price Oct. 31 | Rise or Fall | Yield p.c. £ s. d. |
|---|---|---|---|---|---|
| **Home Electricity Ordinary** | | | | | |
| Bournemouth and Poole .. | 12½ | 12½ | 63/6 | .. | 3 18 9 |
| British Power and Light .. | 7 | 7 | 33/6 | .. | 4 3 7 |
| City of London .. | 7 | 5½ | 30/– | .. | 3 13 4 |
| Clyde Valley .. | 8 | 8 | 42/– | .. | 3 16 0 |
| County of London | 8 | 8 | 43/6 | –6d. | 3 13 9 |
| Edmundsons .. | 6 | 6 | 31/– | .. | 3 17 5 |
| Elec.Dis.Yorkshire | 9 | 9 | 45/6 | .. | 3 19 6 |
| Elec. Fin. and Securities .. | 12½ | 13½ | 60/– | .. | 4 10 0 |
| Elec. Supply Corporation .. | 10 | 10 | 49/– | +6d. | 4 1 8 |
| Lancs. Light and Power .. | 7½ | 7½ | 37/– | .. | 4 1 1 |
| Llanelly Elec. .. | 6 | 6 | 26/6 | .. | 4 10 7 |
| Lond.Assoc.Electric | 3 | 4 | 26/– | .. | 3 1 6 |
| London Electric.. | 6 | 6 | 30/6 | .. | 3 18 8 |
| Metropolitan E.S. | 8 | 8 | 43/6 | – | 3 13 9 |
| Midland Counties | 8 | 8 | 41/6 | .. | 3 17 0 |
| Mid. Elec. Power | 9 | 9 | 44/– | .. | 4 1 10 |
| Newcastle Elec. | 7 | 7 | 31/6 | .. | 4 9 0 |
| North Eastern Elec. | 7 | 7 | 35/– | .. | 4 0 0 |
| Northampton .. | 10 | 10 | 50/– | .. | 4 0 0 |
| Northmet Power | 7 | 7 | 42/– | –1/6 | 3 6 8 |
| Richmond Elec. | 6 | 6 | 26/– | .. | 4 12 4 |
| Scottish Power .. | 8 | 8 | 40/6 | .. | 3 19 0 |
| Southern Areas | 5 | 5 | 23/– | .. | 4 7 0 |
| South London .. | 7 | 7 | 29/6 | .. | 4 15 0 |
| West Devon .. | 5 | 5 | 23/6 | .. | 4 5 1 |
| West Glos. .. | 4½ | 3½ | 25/– | .. | 2 16 0 |
| Yorkshire Elec... | 8 | 8 | 43/– | .. | 3 14 5 |
| **Public Boards** | | | | | |
| Central Electricity : | | | | | |
| 1955–75 .. | 5 | 5 | 114½ | .. | 4 7 4 |
| 1951–73 .. | 4½ | 4½ | 107 | .. | 4 4 1 |
| 1963–93 .. | 3½ | 3½ | 104½ | .. | 3 7 0 |
| 1974–94 .. | 3½ | 3½ | 100 | .. | 3 5 0 |
| London Elec. Trans. | 2½ | 2½ | 98½ | .. | 2 10 9 |
| London & Home Counties 1955–75 | 4½ | 4½ | 112 | .. | 4 0 4 |
| Lond.Pass.Trans.Bd. | | | | | |
| A .. .. | 4½ | 4½ | 120½ | .. | 3 14 8 |
| B .. .. | 5 | 5 | 121½ | .. | 4 2 4 |
| C .. .. | 3 | 3½ | 68 | .. | 4 15 7 |
| WestMidlandsJ.E.A. 1948–68 .. | 5 | 5 | 106½ | .. | 4 14 0 |
| **Overseas Electricity Companies** | | | | | |
| Atlas Elec. .. | Nil | Nil | 7/3 | .. | — |
| Calcutta Elec. .. | 6* | 6* | 47/–xd | .. | 2 11 1 |
| Cawnpore Elec. | 10 | 7 | 39/9 | .. | 3 10 4 |
| East African Power | 7 | 7 | 34/6 | .. | 4 1 4 |
| Jerusalem Elec... | 7 | 5 | 29/– | .. | 3 9 0 |
| Kalgoorlie (10/–) | 5 | 5 | 11/6 | .. | 4 7 0 |
| Madras Elec. .. | Nil | 4 | 29/– | –6d. | 2 15 4 |
| Montreal Power | 1½ | 1½ | 22 | –½ | — |
| Nigerian Elec. .. | 8 | 10 | 33/6 | .. | 5 19 5 |
| PalestineElec."A" | 5* | 5* | 39/– | .. | 2 11 3 |
| Perak Hydro-elec. | 6 | 7 | 13/6 | +6d. | — |
| Tokyo Elec. 6% | 6 | 6 | 27 | .. | — |
| VictoriaFallsPower | 15 | 15 | 4½ | .. | 3 10 7 |
| WhitehallInv.Pref. | — | 6 | 25/6 | .. | 4 14 0 |

| Company | Dividend Previous | Dividend Last | Middle Price Oct. 31 | Rise or Fall | Yield p.c. £ s. d. |
|---|---|---|---|---|---|
| **Equipment and Manufacturing** | | | | | |
| Aron Elec. Ord. | 10 | 15 | 61/– | .. | 4 18 4 |
| Assoc. Brit. Eng. | 6 | 7 | 57/6 | .. | 2 8 9 |
| Assoc. Elec. : | | | | | |
| Ord. .. .. | 10 | 10 | 52/6 | +6d. | 3 16 0 |
| Pref. .. | 8 | 8 | 39/6 | .. | 4 1 0 |
| Automatic Tel.&El. | 12½ | 12½ | 63/– | .. | 3 19 4 |
| Babcock & Wilcox | 11 | 11 | 50/–xd | .. | 4 8 0 |
| British Aluminium | 10 | 10 | 47/– | .. | 4 5 1 |
| British Insul. Ord. | 20 | 20 | 5 7/8 | .. | 3 13 0 |
| British Thermostat (5/–) .. .. | 18½ | 18½ | 20/–xd | .. | 4 12 6 |
| British Vac. Cleaner (5/–) .. .. | 30 | 30 | 29/– | .. | 5 3 5 |
| Brush Ord. (5/–) | 8 | 9 | 10/9 | .. | 4 3 9 |
| Burco (5/–) .. | 15 | 17½ | 17/– | .. | 5 3 0 |
| Callender's .. | 15 | 20 | 5 1/8 | .. | 3 15 6 |
| ChlorideElec.Storage | 15 | 15 | 85/– | .. | 3 10 7 |
| Christy Bros. .. | 12½ | 17½ | 75/– | .. | 4 13 4 |
| Cole, E. K. (5/–).. | 10 | 15 | 33/6 | .. | 2 4 10 |
| Consolidated Signal | 24 | 27½ | 6½ | .. | 4 3 6 |
| Cossor, A. C. (5/–) | 7½* | 10* | 25/6 | .. | 1 19 4 |
| Crabtree (10/–) .. | 17½ | 17½ | 40/6 | –6d. | 4 6 4 |
| Crompton Parkinson Ord. (5/–) .. | 20 | 22½ | 32/– | .. | 3 7 3 |
| De La Rue .. | 35 | 40 | 9 1/16 | – 1/8 | 4 2 8 |
| E.M.I. (10/–) .. | 6 | 8 | 34/6 | –6d. | 2 6 5 |
| Elec. Construction | 10 | 12½ | 57/– | .. | 4 7 9 |
| Enfield Cable Ord. | 12½ | 12½ | 61/– | –1/– | 4 2 0 |
| English Electric | 10 | 10 | 51/3 | +9d. | 3 18 0 |
| Ensign Lamps (5/–) | 25 | 15 | 21/3 | .. | 3 10 8 |
| Ericsson Tel. (5/–) | 22* | 20* | 50/– | .. | 2 0 0 |
| Ever Ready (5/–) | 40 | 40 | 40/9 | +3d. | 4 18 2 |
| Falk Stadelmann | 7½ | 7½ | 34/6 | .. | 4 7 0 |
| Ferranti Pref. .. | 7 | 7 | 31/3 | .. | 4 9 7 |
| G.E.C. : | | | | | |
| Pref. .. .. | 6½ | 6½ | 32/9 | .. | 3 19 4 |
| Ord. .. .. | 17½ | 17½ | 93/3 | .. | 3 15 1 |
| General Cable (5/–) | 15 | 15 | 15/– | .. | 5 0 0 |
| Greenwood&Batley | 15 | 15 | 45/– | .. | 6 13 4 |
| HallTelephone(10/–) | 12½ | 12½ | 31/– | .. | 4 0 8 |
| Henley's (5/–) .. | 20 | 20 | 26/6 | .. | * 3 15 6 |
| 4½% Pref. .. | 4½ | 4½ | 24/– | .. | 3 15 0 |
| Hopkinsons .. | 15 | 17½ | 71/3 | +1/6 | 4 18 2 |
| India Rubber Pref. | 5½ | 5½ | 23/– | .. | 4 15 9 |
| Intl. Combustion | 30 | 30 | 6½ | +½ | 4 12 4 |
| Johnson & Phillips | 15 | 15 | 74/6 | .. | 4 0 6 |
| Lancashire Dynamo | 22½ | 22½ | 98/9 | .. | 4 11 0 |
| Laurence, Scott(5/–) | 12½ | 12½ | 13/– | .. | 4 16 2 |
| London Elec. Wire | 7½ | 7½ | 37/6 | .. | 4 0 0 |
| Mather & Platt.. | 10 | 10 | 55/– | +1/9 | 3 12. 9 |
| Metal Industries (B) | 8 | 8½ | 50/6 | .. | 3 7 6 |
| Met.Elec.CablePref. | 5½ | 5½ | 21/3 | .. | 5 3 6 |
| Mid. Elec. Mfg. | 25 | 25 | 7½ | .. | 3 10 3 |
| Murex .. .. | 20 | 20 | 96/3 | + 1/8 | 4 3 4 |
| Newman Ind. (2/–) | 20 | 20 | 6/– | .. | 6 13 4 |
| Philco (2/–) .. | — | — | 13/– | .. | — |
| Power Securities | 6 | 6 | 29/– | .. | 4 2 9 |
| Pye Deferred (5/–) | 25 | 25 | 32/6 | – 1/8 | 3 17 0 |
| Ransome & Marles | 20 | 20 | 86/3 | .. | 4 12 10 |
| Revo (10/–) .. | 17½ | 17½ | 41/– | +1/– | 4 5 6 |
| Reyrolle .. | 12½ | 12½ | 67/6 | .. | 3 14 5 |

(*Continued on next page*)

* Dividends are paid free of Income Tax.

| Company | Dividend Previous | Dividend Last | Middle Price Oct. 31 | Rise or Fall | Yield p.c. |
|---|---|---|---|---|---|
| **Equipment and Manufacturing** (*Continued*) | | | £ s. d. | | |
| Siemens Ord. .. .. | 7½ | 7½ | 35/6 | .. | 4 4 6 |
| Strand Elec. (5/–) | 10 | 12½ | 10/9 | .. | 5 16 3 |
| Switchgear & Cowans (5/–) .. | 20 | 20 | 18/6 | .. | 5 8 1 |
| T.C.C. (10/–) .. | 5 | 7½ | 22/6 | .. | 3 6 8 |
| T.C. & M. .. | 10 | 10 | 56/– | .. | 3 11 6 |
| TelephoneMfg.(5/–) | 9 | 9 | 12/– | .. | 3 15 0 |
| Thorn Elec. (5/–) | 20 | 20 | 26/3 | +3d. | 3 16 0 |
| Tube Investments | 20 | 20 | 96/– | .. | 4 3 4 |
| Vactric (5/–) .. | Nil | 22½ | 17/3 | +9d. | 6 10 6 |
| Veritys (5/–) .. | 7½ | 7½ | 8/– | .. | 4 13 9 |
| Walsall Conduits(4/–) | 55 | 55 | 50/– | .. | 4 8 0 |
| Ward & Goldstone (5/–) .. .. | 20 | 20 | 30/– | .. | 3 6 8 |
| WestinghouseBrake | 12½ | 14 | 75/– | .. | 3 14 8 |
| West, Allen (5/–) | 7½ | 7½ | 7/6 | .. | 5 0 0 |
| **Traction and Transport** | | | | | |
| Anglo-Arg. Trans. : | | | | | |
| First Pref. (£5) | Nil | Nil | 2/6 | .. | — |
| 4% Inc. .. | Nil | Nil | 7 | –½ | — |
| Brit. Elec. Traction : | | | | | |
| Def. Ord. .. | 45 | 45 | 1195 | .. | 3 15 4 |
| Pref. Ord. .. | 8 | 8 | 180 | .. | 4 9 0 |
| Bristol Trams .. | 10 | 10 | 57/– | .. | 3 10 2 |
| Brazil Traction.. | 1½ | 2 | 27½ | .. | 7 8 7 |
| Calcutta Trams | 6½ | 7½ | 69/6 | +2/– | 2 3 2 |
| Cape Elec. Trams | 5 | 6 | 25/6 | .. | 4 14 1 |
| Lancs. Transport | 10 | 10 | 45/6 | .. | 4 8 0 |
| Southern Rly. : | | | | | |
| 5% Prefd. .. | 5 | 5 | 75½ | .. | 6 12 5 |
| 5% Pref. .. | 5 | 5 | 115½ | .. | 4 7 0 |
| T. Tilling .. | 10 | 10 | 62/– | +2/– | 3 4 6 |
| West Riding .. | 10 | 10 | 46/– | .. | 4 7 0 |
| **Telegraph and Telephone** | | | | | |
| Anglo-Am. Tel. : | | | | | |
| Pref. .. .. | 6 | 6 | 123 | .. | 4 17 7 |
| Def. .. .. | 1½ | 1½ | 30 | .. | 5 0 0 |
| Anglo-Portuguese | 8 | 8 | 27/6 | –6d. | 5 16 4 |
| Cable & Wireless : | | | | | |
| 5½% Pref. .. | 5½ | 5½ | 114½ | .. | 4 16 1 |
| Ord. .. .. | 4 | 4 | 81 | .. | 4 18 9 |
| CanadianMarconi | $1 Nil | 4cts. | 9/– | .. | — |
| Globe Tel. & Tel. : | | | | | |
| Ord. .. .. | 8½* | 5* | 39/– | .. | 2 11 4 |
| Pref. .. | 6 | 6 | 30/6 | .. | 3 18 8 |
| Great Northern Tel. (£10) .. .. | Nil | Nil | 29 | .. | — |
| Inter. Tel. & Tel. | Nil | Nil | 20 | –1 | — |
| Marconi-Marine.. | 7½ | 7½ | 36/6 | +6d. | 4 2 4 |
| Oriental Tel. Ord. | 16 | 10 | 49/6 | .. | — |
| Telephone Props. | Nil | 6 | 21/3 | .. | 5 13 0 |
| Tele. Rentals (5/–) | 10 | 10 | 12/– | .. | 4 3 4 |

* Dividends are paid free of Income Tax.

## Stocks and Shares (*Continued from page* 644)

the latter company stand at 57s. 6d., giving a yield at that price of no more than £2 8s. 9d. per cent., on the basis of the last-paid 7 per cent. dividend.

### Hopkinsons

Hopkinsons ordinary shares are 1s. 6d. up, at 71s. 3d. Since 1940, the company has declared an interim dividend each year of 5 per cent., and this rate is again repeated. In each of the past two years to January 31st, 1943 and 1944, the dividend for the full year was 17½ per cent., following four years' annual dividends of 15 per cent. The report appears in June. In that last issued, it was stated that "production has attained high levels and all departments have worked to maximum capacity." Business in certain export markets has inevitably been seriously curtailed, but the company is in contact with its principal Dominion and all other overseas markets wherever possible.

### Power Securities

The Power Securities Corporation was formed to carry on a general finance business, more especially in the development of electrical and allied undertakings. It owns all the shares of Balfour Beatty & Co., Ltd. The issued capital of £1,300,000 is divided into half a million 7 per cent. preference and 800,000 ordinary shares, all of £1 each. Dividends of 6 per cent. have been paid in each of the past four years, but it is hoped that conditions will permit a return to the 7 per cent. that was consistently distributed for six years previous to the outbreak of war. At the present price of 29s. the yield is £4 2s. 9d. per cent. on the money.

### Ferranti

For the year ended June 30th, 1944, Ferranti has done very well. The net profit at £96,000 is £25,000 up as compared with the previous year and this in its turn showed an increase of nearly £8,000 over the profit for 1941-1942. The company is nearly forty years old. Its issued capital is £500,000 in 7 per cent. cumulative preference stock in £1 units and £300,000 in 10s. ordinary shares; all of the latter are privately held. The ordinary shares for years past have received 6 per cent. tax free dividends. In July, 1943, the board considered it desirable to increase the borrowing powers, and at an extraordinary meeting, the directors were authorised to raise or borrow any sum, for the purpose of the company, not exceeding £3,000,000. The 7 per cent. preference shares, quoted in our lists, stand at 31s. 3d. According to the preliminary figures recently published, the dividend is secured more than five times over and the yield on the money at 31s. 3d. comes to 4½ per cent. There is a reasonably free market in the shares but, as is the case with so many others of similar class, they are at the present time easier to sell than to buy.

# NEW PATENTS

## Electrical Specifications Recently Published

*The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.*

AUTOMATIC Telephone & Electric Co., Ltd.—" Telephone systems and automatic switches for use therein." 5581/43. April 13th, 1942. (564770.)

British Insulated Cables, Ltd., W. N. Mann and E. Lawrenson.—" Electric heating systems for buildings." 9151. June 7th, 1943. (564721.)

British Thomson-Houston Co., Ltd.—"Phosphors." 18115/42. December 31st, 1941. (564700.) " Electric lamp making apparatus." 704/43. January 14th, 1942. (564702.) " Slip-ring assemblies for dynamo-electric machines." 8500/43. May 27th, 1942. (564719.)

British Thomson-Houston Co., Ltd., and A. H. Maggs.—" Dynamo-electric machines." 1239. January 25th, 1943. (564810.)

J. Cash.—" Milling machines, lathes and other electro-motor driven machine tools." 9182. June 8th, 1943. (564781.)

J. A. Crabtree & Co., Ltd., H. F. McLoughlin, B. G. Harrison and R. W. Morgan.—" Electric tumbler switches for alternating current circuits." 8744. June 1st, 1943. (564779.)

D. H. Davies and F. Kirby.—" Means for fixing the heating units of electric fires or heaters." 4698. March 23rd, 1943. (564768.)

Evershed & Vignoles, Ltd., and W. T. Marchment.—" Apparatus for causing a controlled appliance to follow the movements of a controlling device." Cognate applications 9769/43 and 3670/44. June 17th, 1943. (564722.)

General Electric Co., Ltd., and S. S. Beggs.—" Electric radiators and like apparatus." 5542. April 7th, 1943. (564716.)

W. T. Henley's Telegraph Works Co., Ltd., A. W. C. McArthur and C. O. Farrer.—" Apparatus for covering wire." 613. January 13th, 1943. (564740.)

Hoover, Ltd., C. B. Colston and H. G. Dunn.—" Dynamo-electric machines." 5498. April 5th, 1943. (564709.)

Igranic Electric Co., Ltd.—" Apparatus for controlling alternating current electrical circuits." 3892/43. March 11th, 1942. (564764.)

E. T. Jones.—" Automatic volume control in voice-frequency circuits." 3117/42. April 9th, 1943. (564796.)

Marconi's Wireless Telegraph Co., Ltd., and G. B. Banks.—" Super-regenerative radio receivers." 6051. May 9th, 1941. (564731.)

W. H. Norris.—" Telephone systems." 11073. July 8th, 1943. Addition to 554772. (564788.)

E. S. Reid.—" Fibrous conduits and methods of making same." 3441/43. September 5th, 1942. (564845.)

Siemens-Schuckert (Great Britain), Ltd., and S. Flax.—" Rotary power-operated drilling machines." 5742. April 9th, 1943. (564825.)

Siemens-Schuckert (Great Britain), Ltd., and E. A. J. Tunnicliffe.—Conveying apparatus for use in making X-ray examination." 18324. December 24th, 1942. (564805.)

J. M. Sinclair and W. F. Young.—" Spot-welding machine." Cognate applications 7589/43 and 5447/44. May 12th, 1943. (564774.)

Standard Telephones & Cables, Ltd.—" Ultra-high-frequency receiver." 5721/41. July 13th, 1940. (564826.)

Standard Telephones & Cables, Ltd., and P. K. Chatterjea.—" Breaking of electric circuits under abnormal load conditions." 5710. April 9th, 1943. (564822.)

Standard Telephones & Cables, Ltd., and M. M. Levy.—" Balancing of electrical bridge circuits containing a non-linear element." 5401. April 5th, 1943. (564710.)

Standard Telephones & Cables, Ltd., and C. T. Scully.—" Smoothing arrangements for electric power sources." 1946. February 5th, 1943. (564744.)

Telefonaktiebolaget L. M. Ericsson.—" Automatic voltage supervision device for storage batteries." 3765/43. March 7th, 1942. (564847.)

A. V. Tomlinson (Union Switch & Signal Co.).—" Railway track circuit apparatus." 15269. October 30th, 1942. (564800.) " Electromagnetic switches." 14614. October 19th, 1942. (564830.)

E. L. C. White.—" Line amplifiers for high-frequency electric signals such as television signals." 5690. April 9th, 1943. (564821.)

Wilcolator Co.—" Thermally responsive snap-acting apparatus." 4336/43. July 31st, 1942. (564766.)

M. Yardeny.—" Device for tuning radio sets." 29349. November 3rd, 1939. Addition to 524410. (564793.)

*Amended Specification*

555892. British Thomson-Houston Co., Ltd., and others.—" Thermostatic electric switches."

## Vehicle Lighting

POSSIBLE improvements in the lighting of public service vehicles were discussed at a meeting of the N.W. Centre of the Institute of Automobile Engineers, held at the premises of Leyland Motors, Ltd. Mr. A. A. Liardet (managing director of Leyland Motors), who presided, said that the use of infra-red rays at sea and in flying had led people to believe it could also be used on motor vehicles. Mr. W. H. Lund (B. T. H. Co.) said that a perfect fog penetration lamp would appear to be something beyond the reach of man and he was ready to subscribe to the belief that fog was an impenetrable curtain which could not actually be pierced. After discussing some of the technicalities of public service vehicle lighting, Mr. Lund remarked that there were decided possibilities for mercury vapour discharge headlamps. Among problems connected with polarised lighting was a toughened glass, as apparently even a very light film of dust on the headlamp glass would have the effect of de-polarising the light. Mr. S. Markland (assistant chief engineer, Leyland Motors) said that over 1,000 W could be made available for the internal lighting of buses. He doubted if there was a future for high-voltage systems, as the steel body had come to stay and there was no reason for increasing the risk of "shorts" and failures.

# CONTRACT INFORMATION

## Accepted Tenders and Prospective Electrical Work

## Contracts Open

*Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.*

**Australia.**—Western Australian Government Electricity Supply, Perth. Boilers, pulverised coal equipment, economisers, feed pumps, air heaters, mechanical draught plant, pipework, buildings, etc.; two 25,000-kW turbo-alternators and condensing plant, etc.; and one 25,000-kW frequency changer. (October 27th.)

**Chichester.**—November. 23rd. City Council. Underground cables. (See this issue.)

**Edinburgh.**—November 13th. Corporation. Supply and delivery to Granton Gas Works, Edinburgh, of an electrically driven centrifugal submersible pump, complete with automatic switchgear, etc. Specifications, etc., from engineer and manager, Corporation Gas Department, 15, Calton Hill.

**Manchester.**—November 8th. Electricity Committee. Street lanterns. (October 27th.)

**Tredegar.**—November 30th. Urban District Council. Two kiosks, complete with E.h.v. and l.v. control gear, transformers and accessories; E.h.v. 3-core and l.v. cable. (See this issue.).

## Orders Placed

**Bolton.**—Lighting Committee. Accepted. 225 sodium lamps (£707).—Philips Lamps.

**Bradford.**—Electricity Committee. Recommended. 22,500-kW turbo-alternator.—C. A. Parsons & Co. Battery (£3,880).—Marple & Gillott.

**Brighton.** — Public Utilities Committee. Accepted. Repairs to 33,000-kW turbo-generator (£2,805).—C. A. Parsons & Co.

**London.** — Metropolitan Water Board. Accepted. Two transformers and two circuit-breakers for Hammersmith pumping station (£1,248).—Yorkshire Electric Transformer Co.

**Middlesex.**—Emergency Committee. Accepted. Seven traction batteries (£78 5s. 3d. each).—Young Accumulator Co.

**Salford.**—Light, Heat & Power Committee. Accepted. Three-phase oil-immersed power transformers for another twelve months.—Bryce Electric Construction Co.

**Southport.**—Electricity Committee. Accepted. Cables for three years.—British Insulated Cables; Edison Swan Cables.

## Contracts in Prospect

*Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.*

**Ayr.**—Maternity hospital at Heathfield; burgh surveyor.

**Bolton.**—Transformer chamber, Dart Mill Union Road; Dart Mills, Ltd.
Works additions, School Hill; J. C. Birch, Ltd.

**Bury.**—Children's home and staff quarters at Brandlesome House for Education Committee; J. Chadwick, borough engineer, Municipal Office, Bank Place, Bury.

**Cambridgeshire.**—Farm institute; county architect, Shire Hall, Cambridge.

**Cheshire.**—Elementary school, Timperley; E. M. Parkes, county architect, The Castle, Chester.

**Coulsdon.**—Additions, Falcon motor works, Brighton Road; T. Haywood & Sons.

**Derby.**—Extensions to Ripley and District Hospital for outpatients' department and nurses' home; superintendent.

**Glasgow.**—Temporary school at Pennilee (£4,868); city architect.

**Harwich.**—Fire station, Dovercourt; H. French, borough surveyor.

**Hastings.**—Additions, Belle Hill Laundry; Callow & Callow, architects.

**Huddersfield.**—Nurses' homes, Bradley Wood Sanatorium; borough engineer, High Street.

**Hyde.**—Extensions to electrical switchgear, Link House, Newton Street; Ashton, Bros. & Co., Ltd., Cotton Spinners, Carr Field Mills, Hyde, Cheshire.

**London.** — ISLINGTON. — Housing schemes (£1,344,000); Sydney A. Smith and M. K. Matthews, architects.

**Maryport.**—Erection of 200 houses for the North-Eastern Housing Association; Border Engineering Contractors, Ltd., builders, Whitehaven.

**Middlesbrough.**—Canteen, Commercial Street, for Head, Wrightson & Co., Ltd.; F. W. Turnbull, architect, White House, Carlton, Stockton.

**Middlesex.**—Building for canteen, kitchen and dining room at Harrow County School for Boys; county architect.

**Morpeth.**—Completion of 46 partly-built houses at Widdrington Station for the R.D.C.; R. Carse & Son, builders, Amble.

**Northants.**—Extensions to Wellingborough High School and Grammar School (£2,500 each); J. Perkins, county architect, County Hall, Northampton.

**Oxfordshire.**—Maternity unit, grounds of Henley Institution, for Oxford County P.A.C.; county architect, 3, Becket Street, Oxford.

**Rochdale.**—Extensions to Birch Hill Hospital (£102,000); S. H. Morgan, borough surveyor, Town Hall.

**Tynemouth.**—Refuse disposal plant; borough engineer, 19, Howard Street, North Shields.

**Wallasey.**—Temporary school, Gorsey Lane; borough engineer.

**West Drayton (Middlesex).** — Industrial premises, Harmondsworth; Commercial Structures, Ltd., Staffa Road, Leytonstone, E.10.

**West Riding.**—Transformer house, White Rose County Hospital, Wakefield; architect, County Hall, Wakefield.

**Wood Green.**—Extensions, Barratts Factory, Mayes Road; A. Leitch and Partners.

944

rters at
mittee;
unicipal

county

perley;
Castle,

works,

District
t and

Pennilee

t; H.

laundry;

Wood
treet.
tchgear,
Bros. &
Mills,

schemes
M. K.

for the
Border
White-

Street,
F. W.
Carlton,

hen and
or Boys;

tly-built
R.D.C.;

borough
(£2,500
County

nds of
P.A.C.;
rd.
Hospital
urveyor,

borough
ields.
y Lane;

ndustrial
mmercial
ne, E.10.
White
rchitect,

Factory,